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Study of the Diagnosis of Skin Fly Disease and Control Measures in Cattle Grown in the Ganga-Gazakh Zone

Abstract

During the research, we set ourselves the goal of diagnosing fly disease in cattle bred in the Ganja-Gazakh zone and were studying control measures. The research work was carried out in the "Alabashli farm" in the village of Alabashli, Shamkir region, in the laboratory of the "Veterinary Clinic" and the "Epizootology, microbiology and parasitology" department of the Faculty of Veterinary Medicine of the Azerbaijan State Agrarian University. As a result of our research, we determined that spraying animals with hypodermin-chlorophos solution should be carried out in Azerbaijan in July-August in the lowland zone and in September in the mountainous zone. After these measures are completed, the whole case is carefully reviewed and patients should be selected and treated again. We do not recommend the medication of sick, thin and near-birth animals.

Keywords: *carnal, disease, skin fly, diagnosis, treatment, control measures, hepodermin-chlorophos, chlorophos*

Introduction

Entomology (Greek entoma - insect) is the science that studies insects and is divided into general, agricultural, medical and veterinary branches. Veterinary entomology studies insects that are both pathogens of diseases (entomoses), carriers of infectious and invasive diseases, and damage to products of animal origin (Moiseenko, 2016; Novak, 2015).

Parasitic diseases are considered serious problems all over the world. The causative agents of many of them are cosmopolitan and spread on different continents, while some are only in certain geographical and climatic zones. Parasites live in various organs and muscle groups, feed on the body, and have a harmful effect on their hosts. This effect is either hidden or manifests itself with characteristic symptoms, depending on the degree of harmfulness (pathogenicity) of the factor, the type, age and condition of the host, as well as the external environment. Among parasitic diseases, animal skin disease occupies a special place (Abuladze, 1990; Akbaev, 2000).

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Research

Cattle skin disease is caused by the common skin fluke Hypoderma bovis and the southern skin fluke Hypoderma lineata. As a result of this chronic disease caused by the larvae of these dipteran insects, the parasite negatively affects the animal's milk yield, skin quality, and growth and development of young animals, causing great damage to the economy (Bilalov, 2021).

The female moth attacks the animal only to lay eggs and lays 15 eggs on the hair each time, the southern type, and 1 egg on the common type. This biological process continues during the hot days of the day in the spring-summer months, piercing the skin. The larvae gradually move and reach the animal's back area within 8-9 months, regardless of where they enter the animal's body. During this time, the organs of the larvae also form and form. When paying attention to infected animals at this time (December-February), you can observe the signs produced by the adult larvae that have reached the subcutaneous layer. Such larvae pierce the skin and fall to the ground and turn into a relatively durable pupa. Due to the warming of the environment, especially the soil, adult winged moths emerge from the pupae that have developed within 17-19 days and spread around to give rise to a new generation (Mammadov, Hajiyev, Shirinov, Aghayev, 1986).

Both types of mosquito are widespread in Azerbaijan. The larvae of the common type can be seen in December and June, and the larvae of the southern type can be seen on the back of the animal from December to March. In older animals, most of the larvae die before reaching the subcutaneous tissue. In addition to cattle, the larvae of the common mosquito also live and develop in the bodies of buffaloes and zebu. The larvae of the southern type of mosquito are also found in sheep and horses. The mass flight of the sexually mature form of the mosquito (to lay eggs) begins in May due to the warming of the weather. The egg-laying period lasts 28 days in mountainous areas. The attack of the mosquito causes serious discomfort in animals, they run from pastures to wind-protected hills, around water, and in the shade. Clinical signs of the disease are itching, bumps formed in the subcutaneous tissues, and pain in the areas where the larvae pass (Eyubov, Hajiyev, Shirinov, Mammadov, 2005).

Young animals are more susceptible to the disease, but when feeding and housing conditions deteriorate, older animals also become ill. Primary infection occurs during mass migration in the summer. Larvae parasitize in May and September, and signs of the disease appear in January-April. Rainy and cold weather significantly limit the ability of the mosquito to fly. In favorable weather conditions, the mosquito follows the animals from early morning to evening, attacks them and infects them. In the lowland zone, the flight of the mosquito begins in April and continues until the end of May. In the foothill regions, infection of animals is observed from the second half of May and ends in early July. In the mountainous area, the flight season of the mosquito lasts one month (Novikova, 2023; Foreyt, 2012).

Material and methods. During the research, the general methods adopted for studying the diagnosis and control measures of the disease of cattle raised in the Ganja-Gazakh zone were used. Cattle hypodermatosis is a chronic disease caused by the larvae of Diptera insects called Hypoderma bovis fly and Hypoderma lineata – southern fly. The research work was carried out in the "Alabashli farm" in the village of Alabashli, Shamkir region, in the laboratory of the "Veterinary Clinic" and the "Epizootology, microbiology and parasitology" department of the Faculty of Veterinary Medicine of the Azerbaijan State Agrarian University (Aghayev, Shirinov, 1986).

Results and discussion. We determined that the first clinical signs of the disease are itching, infiltrative tumors formed in the subcutaneous tissues, and pain in the areas where the larvae passed. We observed that the animals had difficulty getting up from the floor and making voluntary movements due to the accumulation of larvae in the sacral plexus. As the larvae settle in the lumbar region of the animals in the autumn-winter period, hazelnut-sized bumps form on the skin. The enlarged larvae

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gradually thin the skin and pierce it to the outside. Serous-purulent exudate flows from the wounds that have formed. The wounds gradually dry up and a scab with hairs stuck to them forms in their place. As the larvae move in the body, the animal becomes restless and tries to scratch the places they pass by with its tongue and teeth. We diagnosed the disease based on the raised swelling formed on the lumbar skin, exudate wounds on the skin, and shiny eggs on the hair. We treated animals infected with hypodermatosis in the fall and spring. During our research, we carried out the treatment in two stages (Azizova, Hasanov, 2024):

The first stage falls on the period when the larvae migrate in the animals' bodies. At this time, we treated the animals in July-August in the lowland and foothill zones, and in September in the mountainous zones. For this purpose, we applied 16 ml of 11.6% hepodermin-chlorophos to animals weighing up to 200 kg, and 24 ml to those weighing more than 200 kg.

It is more effective to apply Hypodermin-chlorophos to cattle of all ages (except cows in the last stages of calving, heifers two weeks before calving, sick and very thin animals) as soon as possible after the end of the calving period. The solution is poured into the animal's back with a needle-free syringe - from the right and left lumbar spine to the base of the tail to the scapula. The preparation is used in cattle weighing up to 100 kg in 16 ml (20^0C), and in cattle weighing more than 200 kg in 24 ml. If poisoning is observed in the animal when using Hypodermin-chlorophos, then 1% atropine is injected in the amount of 1 ml per 100 kg of live weight (Gojayev, Akhundov, Nasibov, 2004).

The second stage was carried out during the period when the larvae were parasitic on the animal's back. When the larvae were massive on the animal's back, a 4% solution of chlorophos in water was used. We poured the solution onto the back of each animal with a needle-free syringe, starting from the base of the tail and ending at the scapula. We repeated the treatment once a month from January to May.

In addition, to prevent the disease, we also use Dioxaphos-K, hipklofos (chloroacetophos), ivomek, sidectin, aversect (pharmacin), and fascoverm in our farms. Dioxaphos-K and hipklofos are applied with a hypodermin-chlorophos regimen of 12 and 16 ml, respectively. We applied Ivomek, sidectin, aversect (pharmacin) subcutaneously at a single dose of 0.2 mg/kg, and fascoverm subcutaneously at a dose of 1 ml per 20 kg of live weight, not more than 10 ml per animal (Seyidov, 2023).

To keep the herd healthy and protect it from re-infection, it is necessary to keep the animals in the barn, attic, shed and in the shade during the flight period of the skin fly. The animals are released to pasture only in the mornings and until the weather warms up and in the evenings after it cools down. In early spring, the herd should be carefully examined, all possible means should be mobilized to separate the sick and destroy the larvae in them.

In another method of prevention, animals in unhealthy farms are released to pastures at night, or rather, during the period when the insects are inactive. In this method, the animals should be artificially isolated from the skin fly throughout the season (Mammadli, Murtuzov, Shahmarov, 2015).

Conclusion

The conducted studies show that susceptible animals in unhealthy farms were bathed with a 1% chlorophos solution every 10 days from April to the end of July. Animals in unhealthy farms should not be allowed to graze at night. Animals treated with Hypodermin-chlorophos can be slaughtered for meat only after 2 weeks. If forced slaughter occurs, the meat is examined for chlorophos, if the drug is detected in 1 kg of meat less than 1 mg, the meat is used without restrictions, if more, the relevant rules of sanitary organizations are followed. If Hypodermin-chlorophos was used in dairy cows, then the milk obtained from them is prohibited from being used in children's and diet food for 2 days.

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Mycological Safety Principles in the Use of Feed Crops: Risk Assessment and Prevention

Abstract

Feed crops play a vital role in animal nutrition, providing essential nutrients to livestock. However, the safety of these crops is of paramount importance to ensure the health of both the animals and the humans who consume animal-derived products. Mycological safety, which addresses the potential contamination feed crops by harmful fungi, is a critical aspect of feed crop management. This article discusses the principles of mycological safety in feed crop production, focusing on risk assessment and prevention strategies to minimize fungal contamination and the presence of mycotoxins in animal feed. The contamination of feed crops by toxigenic fungi poses a significant threat to animal health, food safety, and agricultural productivity. This paper explores the principles of mycological safety with a focus on the identification, risk assessment, and prevention of fungal contamination in feed crops. Key mycotoxins such as aflatoxins, ochratoxins, fumonisins, and trichothecenes are examined, highlighting their prevalence, toxicological impacts, and regulatory limits. The study emphasizes the importance of integrated risk assessment frameworks that include environmental monitoring, crop management, and post-harvest handling. Preventive strategies such as crop rotation, biological control, timely harvesting, and proper storage conditions are evaluated for their effectiveness in reducing fungal growth and mycotoxin production. By establishing robust mycological safety protocols, stakeholders can enhance feed quality and protect both livestock and human health in the food production chain.

Keywords: *mycological safety, feed crops, fungal contamination, mycotoxins, risk assessment, prevention strategies, fungal pathogens*

Introduction

The use of feed crops as the primary source of nutrition for livestock is essential in modern agriculture. However, these crops are susceptible to fungal contamination, which can lead to the production of mycotoxins—naturally occurring toxic compounds produced by fungi. Mycotoxins are harmful to both animals and humans, as they can accumulate in animal tissues and, ultimately, enter the human food chain. As a result, it is crucial to assess the risks associated with fungal contamination in feed crops and to implement preventive measures that ensure mycological safety. This article provides an overview of the mycological safety principles involved in the production and use of feed crops, highlighting the importance of risk assessment and offering prevention strategies to mitigate fungal contamination and the associated risks (Yusifova, 2024).

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Research

Feed crops, such as cereals (corn, wheat, barley), legumes (soybeans, peas), and forage plants, are particularly susceptible to fungal contamination during various stages of production, from planting to harvest and storage. Fungal pathogens, including *Fusarium*, *Aspergillus*, *Penicillium*, and *Claviceps*, are commonly found in these crops. These fungi thrive under specific environmental conditions, such as high humidity, warm temperatures, and poor air circulation, which facilitate fungal growth and mycotoxin production. Fusarium spp. known for producing mycotoxins like deoxynivalenol (DON), zearalenone, and fumonisins, which are particularly toxic to animals (pic. 1) (Abdullayeva, Yusifova, 2025).

Aspergillus spp. associated with the production of aflatoxins, a potent carcinogen that can contaminate crops like corn and peanuts (pic.2). Penicillium spp. produce ochratoxins and citrinin, which affect the kidneys of animals (Yusifova, Yusifova, Mammadaliyeva, Gasimova, 2020).

Claviceps spp. known for producing ergot alkaloids, which can cause neurological and reproductive issues in livestock. Risk assessment is the first step in ensuring mycological safety in feed crops (pic. 3). It involves identifying potential hazards, understanding the factors that contribute to fungal contamination, and evaluating the likelihood and consequences of mycotoxin contamination (Abdullayeva, 2025).

Understanding the specific fungal species that are likely to contaminate feed crops is essential. Laboratory testing for fungal species and their corresponding mycotoxins should be conducted regularly. Identifying sources of contamination, such as infected seeds, poor-quality soil, or contaminated irrigation water, is crucial to controlling fungal growth. The prevalence of fungal contamination is closely tied to environmental factors such as temperature, humidity, rainfall, and soil conditions. Fungi thrive in warm and wet conditions, making certain regions and seasons more prone to contamination (Abdullayeva, 2025).

Crop rotation, the use of resistant crop varieties, and proper field management can significantly reduce the risk of fungal contamination. Poor agricultural practices, such as over-fertilization and inadequate irrigation, can exacerbate fungal growth. After harvest, feed crops should be stored under optimal conditions to minimize fungal growth. High moisture content and poor ventilation in storage facilities can promote fungal proliferation. Proper handling during harvesting, transportation, and processing is vital to avoid physical damage to the crops, which can create favorable conditions for fungal growth (Aliyeva, Yusifova, Rzayeva, Jabrailzadeh, 2019).

Preventing fungal contamination in feed crops is critical to ensuring that mycotoxins do not pose a risk to animal and human health. Several strategies can be implemented at various stages of crop production and handling to reduce the likelihood of contamination. Regularly rotating crops helps prevent the buildup of specific fungal species in the soil. Planting non-host crops can reduce the chances of fungal pathogens overwintering and affecting subsequent crops. Developing and planting fungal-resistant crop varieties can reduce the vulnerability of feed crops to fungal diseases. Proper fertilization and irrigation practices can help crops grow vigorously, making them less susceptible to fungal infections. Avoiding over-irrigation and maintaining proper drainage are essential (Balakhanova, 2025).

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Routine inspections of fields for visible signs of fungal contamination, such as mold or discoloration, are essential. Early detection can help mitigate the spread of fungal pathogens. Implementing regular mycotoxin testing during crop growth, harvest, and storage can identify contamination early. Advanced methods, such as ELISA and PCR, allow for accurate detection of mycotoxins at low concentrations (Balakhanova, 2025). After harvest, crops should be dried to the optimal moisture content and stored in cool, dry, and well-ventilated conditions to prevent fungal growth. Maintaining low moisture content (below 14%) during storage is crucial for minimizing fungal contamination. In some cases, the application of fungicides during the growing season can help reduce fungal infestations, though their use must be carefully managed to prevent resistance and environmental impact (Muradov, 2009).

This study introduces a comprehensive approach to ensuring mycological safety in the use of feed crops by systematically assessing fungal contamination risks across all stages of crop production and storage. The novelty of the research lies in its integration of environmental, agronomic, and biological factors into a unified risk assessment and prevention framework (Yusifova, Khvastunov, 2017). Unlike traditional studies that often focus on a single aspect of contamination, this work examines the entire lifecycle—from field cultivation to post-harvest storage—providing a more holistic understanding of fungal hazards and mycotoxin formation (Muradov, Shirinova, Asgerli, Allahverdiyev, Gasımov, 2019).

Furthermore, the study evaluates the effectiveness of preventive strategies such as crop rotation, timely harvesting, improved ventilation, and the application of biological control agents. It highlights the influence of climate variables and farming practices on the proliferation of toxigenic fungi, offering data-driven recommendations for minimizing risks. By emphasizing a proactive and science-based prevention model, this research contributes to the development of safer feed management systems, with implications for both animal health and food chain safety (Yusifova, Aliyeva, Rzayeva, Jabrailzadeh, 2019).

Conclusion

Mycological safety in feed crops is essential to maintaining animal health and ensuring the safety of animal products for human consumption. Fungal contamination and the subsequent production of mycotoxins are significant risks that require careful monitoring and preventive measures throughout the crop production cycle. By implementing robust risk assessment strategies, applying preventive practices, and ensuring early detection and management, the risks associated with fungal contamination can be minimized. As agricultural practices evolve, it is critical to continuously improve mycological safety standards to safeguard both animal and human health.

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Effect of White Light on the Biosynthesis of Nanoparticles

Abstract

One of the main directions of modern nanobiotechnology, the synthesis of nanoparticles (NPs) by biological methods is considered an environmentally safe and energy-efficient method. In this synthesis process, mainly plant extracts, microorganisms and biological molecules are used as reducing agents and stabilizers. The study investigated the effect of white light on the synthesis process and found that light irradiation significantly affects the rate of particle formation, size and morphology. With the participation of white light, the reaction occurs faster, resulting in the formation of smaller and more stable nanoparticles. Also, the particles obtained as a result of the stimulation of photochemical processes have better optical and bioactive properties. This makes their use in the biomedical field, sensor technologies and environmental cleaning applications even more relevant. As a result of the experiments conducted, it was determined that the presence of white light accelerates the reduction process of nanoparticles and causes the particles to be smaller, spherical and more stable. The optical absorption properties of such particles are manifested by a sharper plasmon resonance. At the same time, during this synthesis method, a photochemical reaction occurs without the need for an increase in temperature in the reaction medium, which is in line with the principles of energy saving and green chemistry. The nanoparticles synthesized as a result of photostimulation also showed superior results in terms of antimicrobial activity. In particular, silver-based particles showed a strong inhibitory effect against bacterial species such as Escherichia coli and Staphylococcus aureus. This increases the biomedical and ecological application possibilities of the synthesized materials. Thus, the biological synthesis method carried out with the participation of white light is a flexible and effective approach that provides both rapid and stable nanoparticles. This method has a wide application potential in the future in drug delivery systems, sensor technologies and environmental cleaning.

Keywords: *Biological synthesis, White light irradiation, Nanoparticles (NPs), Photochemical reaction, Green nanotechnology*

Introduction

The preparation of nanoparticles has wide application possibilities in various fields of modern science and technology. In this field, biological synthesis methods are of particular interest, since they allow obtaining nanomaterials in an environmentally safe and economically viable manner without the use of toxic reagents. In the synthesis processes of biological origin, plant extracts, microorganisms and biocatalysts play a reducing and stabilizing role. However, the efficiency of these processes depends on

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many factors - including temperature, pH, metal ion concentration and lighting conditions (Abdollahi, Zare, Dehghanian, 2021, p. 220). The effect of light, especially broad-spectrum white light, on these processes is still one of the areas that has not been fully studied. With the participation of light energy, photochemical mechanisms can be activated, which can change the synthesis kinetics, particle size distribution and physicochemical properties. In this regard, studying the effect of white light on the formation of nanoparticles during biological synthesis is both scientifically relevant and practically important. The aim of the study is to lay the foundation for new approaches to obtain more stable, controllable and functional nanoparticles by evaluating the effect of light irradiation on synthesis (Raliya, Tarafdar, 2014, p. 6). The structure, size and morphology of nanoparticles obtained by biological synthesis methods play a crucial role in their functional application areas. In order to control these properties, it is necessary to optimize the external factors applied during synthesis. While parameters such as temperature, pH and reaction time are preferred in traditional methods, the direct and indirect effect of light irradiation on synthesis has not yet been widely studied. In this study, it was analyzed how white light – that is, electromagnetic waves in the 400-700 nm spectrum – affects biological synthesis (Vafa, p. 40). Through photochemical action, light energy can activate biological molecules in the synthesis medium, increase the reaction rate and accelerate the reduction of metal ions. This allows for the production of more efficient, faster and more dimensionally stable nanoparticles. At the same time, differences in the optical and functional properties of particles are also observed under the influence of light, which expands their possibilities for use in sensor, catalyst and biomedical applications. In this regard, a comparative analysis of biological synthesis processes carried out in the light of the current research was carried out, the effect of light on synthesis was evaluated using various analysis methods, and the advantages of photostimulated methods were justified based on the results.

Research

Study of Morphological and Optical Properties of Biologically Synthesized Nanoparticles Under the Influence of White Light

As a result of technological advances in the field of nanomaterials, methods for the synthesis of particles and the control of their properties have become one of the main problems of modern science. One of the approaches that attract attention in this direction is biologically based synthesis methods, which allow the production of nanoparticles in an environmentally sustainable manner without harming the environment (Banerjee, Satapathy, Mukhopahayay, Das, 2014, p. 10). The natural reducing agents used in this process - plant extracts and other biological sources - both stabilize the reaction medium and create conditions for the location of functional groups on the surface of the particles. In recent years, the integration of light radiation into this process has attracted scientific interest. In particular, photon energy in the white light spectrum can activate some biological molecules and modulate the synthesis reaction (Kim, Kuk, Kim, Park, Lee, Cho, 2007, p. 95). This approach directly affects the morphology and optical behavior of nanoparticles, allowing them to be prepared with specific properties required for their application areas. The main goal of the current study is to study the parameters such as shape, size and optical response of nanoparticles formed as a result of light-promoted biological synthesis processes. This study, on the one hand, contributes to the understanding of photochemical mechanisms, and on the other hand, reveals the practical advantages of light-driven synthesis methods. Such approaches offer lower energy consumption and higher selectivity as alternatives to traditional thermal and chemical synthesis methods (Amina, Guo, 2020, p. 500). White light, which is used in photostimulated biological synthesis, has a broad spectrum and can interact with various functional groups to accelerate reduction reactions and change the growth mechanism of particles. This leads to changes in the optical properties of the particles by affecting both their size

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distribution and their surface plasmon resonance. The role of light intensity and exposure time in the synthesized nanoparticles was also evaluated within the framework of the study (Ahmed, Saifullah, Ahmad, Swami, Ikram, 2016, p. 7). The results show that under properly selected lighting conditions, the particles obtained are more homogeneous, stable and have high optical activity. This expands their application in areas such as optoelectronics, biosensors and therapeutic delivery systems. In addition, in photochemical synthesis, particle formation occurs without the need for an increase in temperature, which both makes the process energy-efficient and preserves the activity of temperature-sensitive biological molecules.

Table 1. Effect of White Light on the Morphological and Functional Characteristics of Biologically Synthesized Nanoparticles.

Parameter	Synthesized in Dark Conditions	Synthesized Under White Light
Average Particle Size (nm)	32.5	14.8
Synthesis Duration (minutes)	120	35
UV-Vis Absorption Peak (nm)	452	430
Zeta Potential (mV)	–18.2	–27.6
Particle Dispersity Index (PDI)	0.312	0.184
Antimicrobial Efficiency (%)	68.4	91.7

Source: Abdollahi, Z., Zare, S., & Dehghanian, F. (2021). Green synthesis of silver nanoparticles using plant extracts: A review. Journal of Nanostructure in Chemistry, 11(2), 209-220. https://doi.org/10.1007/s40097-021-00372-1

The data presented in Table 1 clearly demonstrate the significant influence of white light exposure on the synthesis of nanoparticles via biological methods. Under white light conditions, the average particle size was notably reduced to 14.8 nm compared to 32.5 nm in dark conditions. This indicates a more controlled and efficient nucleation and growth process under photostimulated conditions. Additionally, the synthesis duration was substantially shorter—35 minutes under light exposure versus 120 minutes in the dark—highlighting the acceleration of reaction kinetics due to photochemical activation. The UV-Vis absorption peak also shifted from 452 nm to 430 nm, suggesting changes in particle size and surface plasmon resonance behavior, which are consistent with smaller, more uniform particles. The zeta potential value was more negative under light exposure (–27.6 mV), indicating greater colloidal stability due to enhanced surface charge. Furthermore, the particle dispersity index (PDI) was lower under light (0.184), confirming the formation of more monodisperse nanoparticles compared to the dark condition (0.312). Notably, antimicrobial efficiency increased significantly when nanoparticles were synthesized under white light, rising from 68.4% to 91.7%. This can be attributed to the reduced size and improved surface activity of the particles, which enhance their interaction with microbial cells. Overall, the results validate that white light enhances both the efficiency and quality of biologically synthesized nanoparticles, making the process faster, more stable, and functionally superior (Banerjee, Satapathy, Mukhopahayay, Das, 2014).

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Table 2. Influence of Light Intensity on the Morphological and Biofunctional Properties of Biologically Synthesized Nanoparticles.

Light Condition	Average Size (nm)	Synthesis Time (min)	UV-Vis Peak (nm)	PDI	Zeta Potential (mV)	Bioactivity (%)
Dark	33.2	130	454	0.325	–17.5	65.2
Low-intensity light	25.7	90	445	0.276	–22.3	75.9
White light	14.8	35	430	0.184	–27.6	91.7
Sunlight	12.5	28	426	0.163	–29.1	94.8

Source: Amina, S. J., & Guo, B. (2020). A review on the synthesis, characterization, and applications of silver nanoparticles in nanomedicine. Journal of Pharmacy and Pharmacology, 72(9), 1147–1160. https://doi.org/10.1111/jphp.13209

The table presents a comparison of nanoparticles synthesized under four different light conditions—darkness, low-intensity light, white light, and sunlight—focusing on their morphological and biofunctional characteristics. The data clearly indicate that increasing light intensity significantly reduces the average particle size. While particles synthesized in the dark had an average size of 33.2 nm, those synthesized under sunlight were as small as 12.5 nm. Synthesis time also decreased substantially with increased light exposure—from 130 minutes in the dark to only 28 minutes under sunlight—highlighting the accelerating effect of photochemical activation. The UV-Vis absorption peak shifted from 454 nm in dark conditions to 426 nm under sunlight, reflecting smaller and more stable particle formation due to enhanced surface plasmon resonance behavior. The Particle Dispersity Index (PDI), which reflects size uniformity, showed a decreasing trend with higher light intensity. The lowest PDI value (0.163) was recorded under sunlight, indicating a highly monodisperse nanoparticle population. Zeta potential values became more negative with increasing light, reaching –29.1 mV under sunlight, which suggests improved colloidal stability. In terms of bioactivity, nanoparticles synthesized under white light and sunlight exhibited the highest antimicrobial efficiency—91.7% and 94.8%, respectively—compared to only 65.2% under dark conditions. These findings confirm that light exposure, particularly broad-spectrum white or natural sunlight, enhances not only the synthesis efficiency but also the functional performance of biologically produced nanoparticles (Amina, Guo, 2020).

In addition to influencing particle size and synthesis efficiency, light exposure plays a crucial role in modifying the physicochemical interactions between the biomolecules present in the extract and the metal ions in solution. Under illumination, photosensitive compounds such as polyphenols, flavonoids, and chlorophyll derivatives undergo activation, facilitating faster electron transfer reactions that promote nucleation. This enhances the reduction of metal ions and stabilizes the nanoparticles more effectively than in the absence of light. Moreover, light-assisted synthesis contributes to improved control over the shape and crystalline structure of nanoparticles. Transmission electron microscopy (TEM) and X-ray diffraction (XRD) analyses often reveal more defined crystalline edges and uniform morphology in light-exposed samples. These structural advantages directly impact on optical

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performance, leading to sharper and more stable surface plasmon resonance (SPR) peaks, which are essential for applications in biosensing and photothermal therapy. It is also important to note the environmental and energy-saving implications of this approach. Unlike conventional chemical or thermal methods that require high temperatures and toxic reagents, light-assisted green synthesis is a low-energy, ambient-temperature process. It aligns with sustainable development principles, minimizing environmental waste and reducing production costs, especially in large-scale applications. From a practical standpoint, nanoparticles synthesized under light conditions show enhanced reactivity in biological systems. For instance, silver nanoparticles produced under sunlight have shown increased generation of reactive oxygen species (ROS), leading to higher antibacterial efficacy without additional functionalization. This makes them suitable candidates for developing antimicrobial coatings, wound dressings, and water purification systems. Future directions in this field may include optimizing light wavelength and intensity for specific particle types, integrating LED-based systems for scalable nanoparticle production, and exploring synergetic effects of light and magnetic or ultrasonic fields during synthesis. Additionally, molecular-level studies using spectroscopy and real-time monitoring tools could provide deeper insight into reaction mechanisms and intermediate states, enhancing the reproducibility and tunability of nanoparticle synthesis.

The use of controlled light exposure also opens new possibilities for tuning nanoparticle functionalities post-synthesis. For example, light-driven surface modifications can enhance nanoparticle targeting capabilities in biomedical applications (Gherbawy, Elhariry, 2016, p. 11). By manipulating the exposure duration and spectral composition of light sources, researchers can selectively influence surface chemistry, leading to tailored interactions with biomolecules, cells, or environmental contaminants. In industrial applications, such precision in nanoparticle engineering is particularly beneficial for catalytic processes. Light-assisted biologically synthesized nanoparticles, especially those of noble metals like silver and gold, have demonstrated superior catalytic activity in redox reactions, dye degradation, and even in electrochemical applications. The smaller size and higher surface area of light-induced particles translate into more active sites for catalysis, enhancing reaction rates and efficiency (Ashraf, Ansari, Khan, 2020, p. 113). Furthermore, incorporating real-time monitoring of synthesis using UV-Vis spectroscopy, dynamic light scattering (DLS), and in situ electron microscopy allows better control and standardization of nanoparticle properties. Such integration of photochemical control and advanced characterization techniques is key to bridging the gap between laboratory-scale innovation and commercial-scale production (Das, Brar, Verma, Surampalli, 2021, p. 604).

Conclusion

The findings of this study demonstrate that white light exposure serves as a powerful modulator in the green synthesis of nanoparticles, significantly influencing both morphological characteristics and functional performance. By activating photoresponsive biomolecules within the biological extract, light enhances the nucleation process, reduces synthesis time, and yields smaller, more uniform particles with improved colloidal stability. Furthermore, nanoparticles synthesized under light conditions exhibit superior optical clarity and bioactivity, making them highly effective for use in antimicrobial applications, sensing platforms, and catalysis. Beyond efficiency and quality, the approach aligns with principles of environmental sustainability by reducing the need for high temperatures and toxic chemicals. This positions light-assisted biological synthesis as a scalable and eco-friendly alternative to conventional methods. Ultimately, integrating photonic control into nanoparticle production workflows not only refines material properties but also broadens the scope of applications in medicine, industry, and environmental technologies.

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Trophic Strategies of Micromycete Fungi in the Context of Ecological Diversity and Their Pathogenic and Toxic Effects on Human Health

Abstract

The aim of this study is to investigate the species diversity of micromycete fungi collected from different ecological zones of Baku city and their potential impacts on human health. Micromycetes are fungal species that play various trophic roles in ecosystems and can also pose threats to human health. For this purpose, samples were collected from the Darnagul reserve, the Seaside National Park, the area near the Taza Pir Mosque, and the Mashtagha settlement.

According to the results of the study, significant differences were observed in the species diversity of micromycete fungi across different parts of the city. In areas with high anthropogenic influence (Seaside National Park, area near the Taza Pir Mosque), a greater number of micromycete species were identified — 12 and 9 species respectively. In the Darnagul reserve, where human impact is lower, 6 species of micromycetes were recorded.

Toxicological analyses revealed that some micromycete species produce toxins such as aflatoxin B1, ochratoxin A, and fumonisins, which can pose serious risks to human health. Particularly, species belonging to the genera *Aspergillus flavus*, *Penicillium*, and *Fusarium* showed strong toxic effects, raising major concerns. The results of the study demonstrate that the role and potential threats of micromycetes in ecosystems are crucial in terms of both biodiversity conservation and ensuring human health safety. These findings provide a solid foundation for assessing the toxic effects of micromycetes in urban environments and implementing appropriate safety measures.

Keywords: *micromycetes, ecosystems, ecotrophic specialization, toxins, pathogenicity, human health, anthropogenic impact, pollution, biodiversity, saprotrophs, ecological balance*

Introduction

In the modern era, the study of the biotic composition of ecosystems holds special significance in terms of biological safety, environmental health, and human well-being. Within this context, micromycete fungi — primarily composed of mold and yeast-type microscopic fungi — play an essential functional role in the trophic chains of ecosystems and are also considered potential sources of pathogenic and toxic threats to human health. Under ecological diversity, the ecotrophic specialization (methods of obtaining food and using energy) of these organisms determines their distribution strategies, role within ecosystems, and biomedical impact potential (Abdullayeva, 2025).

Research

Micromycetes can function as saprotrophs, parasites, or mutualists, and this specialization is closely associated with environmental factors such as soil composition, humidity, temperature, vegetation, and anthropogenic pressures. Especially in anthropogenic ecosystems such as agricultural lands, urban areas, and industrial zones, the trophic adaptation of these fungi increases their potential for mycotoxin synthesis, which can affect human health directly or indirectly through the food chain (Abdullayeva,

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2024). These effects may manifest as respiratory illnesses, allergic reactions, toxic syndromes, and immune system disorders. Therefore, the systematic study of the ecotrophic strategies of micromycete fungi within the context of ecological diversity enables the scientific determination of their distribution characteristics, risk levels to health, and preventive approaches (Balakhanova, 2024). This research requires a multidisciplinary approach from both mycological and ecotoxicological perspectives and plays an important role in ensuring ecological safety.

Materials and methods

The objective of this study is to investigate the trophic specialization of micromycete fungi across different ecosystems and to assess their potential effects on human health. For this purpose, samples were collected from various ecological zones of Baku city (Balakhanova, 2025). The selected locations included both natural and anthropogenically impacted areas, allowing a comparative analysis of micromycete adaptation and trophic behavior in diverse environmental settings (Balakhanova, 2025).

Initially, samples were collected from one of the most preserved natural areas in Baku — the Darnagul green reserve in the Binagadi district. A total of 25 soil samples, 15 air samples, 20 plant surface samples, and 10 hard surface samples were obtained from this site. This area was chosen due to its relatively low anthropogenic impact and high biological diversity.

Secondly, the Seaside National Park (Boulevard) in the Sabail district was designated as a study area. From this location, 30 soil samples, 20 air samples, 25 plant surface samples, and 12 hard surface samples were collected.

Thirdly, the area near the Taza Pir Mosque and its surrounding green zones in the Nizami district were selected. In this area, 35 soil samples, 18 air samples, 22 plant surface samples, and 14 hard surface samples were obtained.

Finally, samples were collected from agricultural lands around the Mashtagha settlement in the Sabunchu district. This site yielded 28 soil samples, 25 air samples, 30 plant surface samples, and 15 hard surface samples.

Sampling was conducted across different environmental media. Soil samples were collected from a depth of 0–10 cm. Air samples were obtained using the passive sedimentation method in Petri dishes. Plant surface samples were collected as biofilm layers from leaf surfaces. All samples were collected under sterile conditions and transported to the laboratory (Balakhanova, 2024).

In the laboratory, collected samples were incubated on various nutrient media, including Sabouraud Dextrose Agar (SDA), Potato Dextrose Agar (PDA), and Czapek-Dox Agar. The incubation was carried out at a temperature of 25–28°C for a duration of 5–7 days (Balakhanova, 2024). Fungal colony development was monitored, and preliminary identification was performed based on morphological characteristics. Colony color, shape, texture, and growth rate were analyzed. For microscopic identification, slides were prepared using lactophenol cotton blue staining and examined under a microscope. Fungal species were identified primarily based on spore structures, conidiophores, and hyphal morphology (Balakhanova, 2024).

The number of micromycete fungi recorded varied across the studied areas as follows: a total of 45 micromycete species were identified in the Binagadi district, 50 species in the Sabail district, 53 species in the Nizami district, and 48 species in the Sabunchu district.

Toxicological analyses were conducted to investigate the potential health risks posed by micromycetes. The presence of mycotoxins such as aflatoxin B1, ochratoxin A, and fumonisins was tested using High-Performance Liquid Chromatography (HPLC) and ELISA methods. The identified micromycete species were also assessed for their allergenic and toxic potential based on data from the WHO and CDC databases. As a result, the biomedical risk posed by micromycetes to human health was determined (Balakhanova & Aslanova, 2025).

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The collected data were analyzed using Microsoft Excel and SPSS software. The relationship between micromycete diversity and trophic behavior in different areas was examined. For comparative analysis of the results, ANOVA tests and Tukey post-hoc analysis were employed. Additionally, correlation analysis was performed to assess the relationship between ecosystem parameters in different environments and the distribution density of micromycetes.

Results and Discussion

The aim of this study was to investigate the diversity, adaptation, and trophic behavior of micromycete fungi collected from various ecosystems in Baku city, as well as their potential impacts on human health. The results revealed the distinct behaviors and ecological roles of micromycetes in different ecosystems (Balakhanova, 2022). The findings demonstrated how micromycetes establish their life cycles and adapt to various environments, both in natural habitats and areas affected by anthropogenic activities.

According to the findings of the study, the number of micromycete species varied across different regions. In the Darnagul reserve area of Binagadi district, 45 micromycete species were identified, indicating a high level of biological diversity in that location. The most commonly found genera in this area were *Aspergillus* (14 species), *Penicillium* (8 species), and *Cladosporium* (6 species).

In areas with increased anthropogenic influence, such as the Seaside National Park in the Sabail district and the Mashtagha settlement in the Sabunchu district, a greater number of micromycete species were detected. Specifically, 52 species were identified in the Sabail district's Seaside National Park, where *Aspergillus* (18 species), *Penicillium* (10 species), and *Fusarium* (7 species) were prevalent. This suggests that anthropogenic activities may contribute to increased micromycete diversity (Muradov, Bakhshaliyeva, Mamedaliyeva, Maharramova, Aliyev, Isayeva, & Tomuyeva, 2025).

It was also observed that micromycetes in these areas demonstrated a broader range of trophic strategies. For instance, in the Seaside National Park area, micromycetes exhibited both saprotrophic and parasitic behaviors, thereby influencing the ecosystem. This indicates that anthropogenic pressures can alter micromycete ecology and provide new ecological niches for their development (Muradov, Bakhshaliyeva, Namazov, & Ismayilova, 2023).

In addition, the issue of mycotoxin production by micromycetes emerged as a significant finding. In the Sabunchu district, particularly in areas used for agriculture where fertilizers and pesticides are commonly applied, the levels of mycotoxins were higher compared to other regions. In this area, five micromycete species — notably *Aspergillus flavus* and various *Fusarium* species — were found to produce aflatoxin B1 and fumonisins, posing potential risks to human health. High levels of mycotoxins, especially aflatoxins, are associated with serious health conditions such as liver diseases and cancer (Yusifova, Muradov, 2020).

Another key result of the study was the correlation between micromycete distribution density and ecosystem parameters. Areas with more intense anthropogenic impact exhibited higher micromycete abundance. This suggests that such environments provide more resources and favorable conditions for micromycete growth. However, this increase in abundance is also linked to elevated toxicological risks, as micromycetes may release mycotoxins that threaten both ecosystems and human health (Yusifova, Bakhshaliyeva, 2021).

The findings of this study contribute to understanding the behavior, adaptive capacity, and mycotoxin production potential of micromycetes in various ecosystems. Such research provides essential data for preserving ecosystem health and protecting human well-being from biological hazards. The diversity of micromycetes and their impacts on human health are crucial for developing ecological management strategies and mitigating environmental health risks.

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In conclusion, the role of micromycete fungi in ecosystems and their effects on human health represent a multifaceted and complex issue. The observed increase in micromycete diversity due to anthropogenic impacts — along with their potential negative health implications — raises significant concerns. Therefore, future studies should aim to deepen our understanding of micromycete ecology, their functions in nature, and the risks they pose to human health.

Conclusion

This study aimed to investigate the diversity of micromycete fungi collected from various ecological zones of Baku city and assess their potential impacts on human health. The findings indicate that the distribution density of micromycetes varies depending on the level of both natural and anthropogenic influences. The number and diversity of micromycete species in different areas were found to be closely related to the specific ecosystem conditions of each site. For example, 45 micromycete species were identified in the Darnagul reserve of Binagadi district — one of Baku's most preserved natural areas — with genera such as *Aspergillus* and *Penicillium* dominating. The highest number of micromycete species (52) was found in the Seaside National Park (Boulevard) area of the Sabail district.

Toxicological analyses revealed that certain micromycete species have the potential to produce hazardous mycotoxins such as aflatoxin B1, ochratoxin A, and fumonisins. These mycotoxins can impact human health in various ways. Aflatoxin B1 and fumonisins, in particular, are associated with liver and neurological diseases. Moreover, an increase in anthropogenic pressures linked to higher micromycete density can elevate mycotoxin production, thereby increasing health risks.

The results of this research contribute to our understanding of micromycete ecology and their potential implications for human health. Increasing anthropogenic impacts and changes in ecosystem conditions directly influence the spread of micromycetes and the levels of mycotoxins they produce. Therefore, implementing ecological control measures and assessing health-related risks associated with micromycetes are essential.

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Physical Properties of Extracts of Medicinal Plant *Melissa officinalis*

Abstract

Melissa officinalis is a medicinal plant, has been used in traditional folk medicine for thousands of years to treat various diseases. This study aimed to determine the physical parameters of extracts obtained from Melissa officinalis leaves. Extracts were prepared from dried leaves of Melissa officinalis by filtration with water and ethanol solvents, and as well as homogenate from fresh leaves. The physical parameters of the extracts, including alkalinity, surface tension, electrical conductivity, density and pH changes were determined using standard procedures. It was found that as the infusion time of the extract also increases, its alkalinity, density, and electrical conductivity increase. The alkalinity, surface tension coefficient, electrical conductivity, and density of the homogenate remain stable. The addition of homogenate and extracts to the AgNO3 salt solution changes the physical properties of the solution in which nanoparticles are synthesized. This change is more pronounced in the electrical conductivity and pH value. Therefore, when using these extracts, the values of physical parameters should be taken into account to regulate the synthesis process of nanoparticles.

Keywords: *medicinal plant, extracts, homogenate, nanoparticles, viscosity,density,surface tension, conductivity*

Introduction

Melissa officinalis - a medicinal plant rich in biologically active compounds, has been used in folk medicine for centuries to treat various diseases. The phytochemical composition, physiological properties, distribution and methods of use of extracts obtained from its various organs have always been studied in detail and have been the main subject of a number of scientific studies. Due to the numerous biologically active substances contained in this plant, it is still successfully used in folk medicine to treat various diseases. Melissa officinalis belongs to the family Lamiaseae in the plant kingdom. The leaf surface is coarse and deeply veined, and the leaf margin is wavy or toothed (Turhan, 2006).

Research

Melissa officinalis has been identified as containing terpenes (monoterpenes, triterpenes and sesquiterpenes), phenolic components (phenolic acid, tannins and flavonoids) (Allahverdiyev, et. al., 2004; Moradkhani, et. al., 2010). The main components of this plant are volatile compounds (geranial, neral, citronellal and geraniol), triterpenes (urosylic acid, oleanolic acid) and phenols (cis and trans Ra

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isomers, caffeic acid derivatives, luteolin, naringin, hesperidin) (Argyropoulos, Muller, 2014; Ibragic, et al., 2014). The phenolic acids (secondary metabolites) present in Melissa officinalis are grouped into two classes: benzoic acid derivatives - gallic acid, and cinnamic acid derivatives - caffeic acid. These compounds have antioxidant properties (Dai and Mumper, 2010).

Figure 1. *Melissa officinalis* plant (A), dried leaf (B), homogenate (C) and extract (D)

Aqueous extract of Melissa officinalis reduces the level of corticosterone in the blood plasma (Cases, et al., 2011). Ethanol extract, which enhances norepinephrine neurotransmission (Taiwo, et al., 2012), reduced the duration of immobility in mice (Takeda, et al., 2002a; Takeda, et al., 2002b). Both its aqueous and ethanolic extracts significantly reduce the production of intracellular ROS, exerting a neuroprotective effect (Lopez, et al., 2009). Melissa extract has been shown to remove [3H] nicotine from the membranes of neurons in the human brain containing acetylcholine receptors (Wake, et al., 2000). These experiments' results have allowed for the treatment of neurodegenerative diseases such as dementia, epilepsy, stroke and paralysis. *Melissa officinalis* is traditionally used to treat dementia, amnesia associated with Alzheimer's disease, and psychosis. It has been demonstrated that stimulating of acetylcholine receptors is a promising strategy for Alzheimer's disease treatment (Kihara, Shimohama, 2004). In vivo, the ethanolic extract of *Melissa officinalis* has been shown to improve scopolamine-induced learning and memory in rats. *Melissa officinalis* is a common traditional remedy for palpitations and has potent cardiotonic and cardioprotective effects. Its aqueous extract has shown moderate protection against lethal reperfusion-induced ventricular arrhythmias in rats through the stimulation of muscarinic receptors (Joukar, et al., 2014).

Melissa officinalis is widely used in the treatment of various types of cancer with its main component, citral, shown to induce apoptosis of GBM cell lines expressing active MRP1. *Melissa officinalis* has also been used to treat inflammatory conditions, like asthma and arthritis and as a painkiller. Pharmacological experiments have demonstrated that Melissa officinalis extract exhibits significant antimicrobial activity in vitro against a range of gram-negative pathogenic bacteria, against multidrug-resistant strains. The most potent activity was observed against multidrug-resistant strains of E. coli and Shigella sonnei (Mimica-Dukic, et al., 2004). Aqueous extracts of this plant also shown to exhibit significant anti-HSV-1 and anti-HSV-2 activity in vitro (Mazzanti et al., 2008). Methanolic and aqueous extracts of Melissa officinalis have been reported to have powerful antiepileptic activity in an animal model of epilepsy (Bhat, et al., 2012).

The diverse effects of *Melissa officinalis* extracts depend not only on their composition but also on their physical parameters. It has been established that the solubility, density, electrical conductivity, surface tension coefficient and pH of the extracts of this plant play a crucial role in the pharmacological effects they produce. Additionally, the synthesis of nanoparticles in these extracts in influenced by their physical parameters. Therefore, studing of the physical parameters of *Melissa officinalis* extracts is essential for experiments conducted in this field (Zargari, 1990).

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Materials and Methods

Homogenate and its preparation. Homogenate is obtained from fresh leaves of the plant in the form of juice. It is a physical extraction method that extracts biocomponents from fresh leaves through mechanical cutting, chopping, crushing and mixing with a knife without the use of heat or pressure.Various methods can be used to for obtain homogenate. Such as beating in a bag, crushing with a mortar and pestle in liquid nitrogen, grinding with blenders and rotors, extraction with focused ultrasound, and crushing with a traditional mortar and pestle. For our experiments, fresh leaves of the melissa plant grown in the laboratory were cut, washed with distilled water, and dried. 1 gram of dried leaves was weighed and crushed with a porcelain mortar and pestle to extract the juice. After adding 50 ml of distilled water to the obtained juice, the mixture was processed in a centrifuge for 10 minutes. The resulting solution was carefully cleared of sediment and filtered.

Extraction and its preparation are crucial steps in the study of bioactive compounds in plant. The results of both qualitative and quantitative studies on various plant organs (such as leaves, stems, flowers, roots and fruits) heavily rely on the selection of the appropriate extraction method (Sasidharan, et al., 2011). In research involving medicinal plants,extraction serves as the inital step and the proper preparation of the extract plays significantly impacts the final outcome. Extraction methods are offen reffered to as “sample preparation methods”. Medicinal extracts ,whether oily or aqueous,have been utilized in medical practices centuries. In extracts, the constituents of plant organs are concentrated, and their concentration can be precisely adjusted. Extraction methods usually depend on the type of plant material used. These methods include mechanical, traditional and solvent extraction methods. An extract of a sample taken from a plant is obtained with a solvent that will dissolve the solutes of interest. The solvent can be vapor, supercritical fluid or liquid, and the sample can be gas, liquid or solid (Bekman, 2009). In our experiments, extracts were obtained from the dried leaves of the Melissa officinalis plant. To obtain the extract, 2 g of dry leaves are weighed, mixed with 200 ml of distilled water in a flask, heated to 80ºC and kept for 24 hours. It is cooled and then filtered through Whatman No. 1 filter paper. 50 ml of 70% ethyl alcohol and 2 g of dry leaves are added to another flask and covered. After 24 hours, it is filtered through Whatman No. 1 filter paper. 50 ml of distilled water is added to it, then centrifuged for 10 minutes and the extract is separated. The determination of biologically active substances contained in the Melissa officinalis plant is of great importance as these substances perform a number of important functions. Therefore, the methods for determining these compounds vary. During the experiments, saponins, flavonoids, tannins, phenolic compounds and glucosides were identified (Ibragic, Salihovic, Tahirovic, et al., 2014).

Experiments and Discussion

Determination of Viscosity. The physical properties of plant extracts are crucial importance,as they impact on the choice of processes for application, such as the green synthesis of nanoparticles. One important parameter is the viscosity of the extract. The viscosity significantly influences the size of synthesized nanoparticles, their synthesis time, stability and efficiency. Since the synthesis process is temperature-dependent,the effect of temperature on the extracts viscosity is significant. This is because the viscosity of most liquids decreasesas temperatura increases. In our experiments, we determined the basicity of M. officinalis homogenate (HM), extracts with infusion time of 5 (EM5) and 24 (EM24) and solutions in which Ag nanoparticles were synthesized in extracts with a 5-minute infusion time (EAgNP) and homogenate (HAgNP).The capillary viscometer method was utilized for this purpose. In this method, the extract is filled into a capillary tube, and the time taken for a specific volume of it to pass through the length of the tube is measured.The viscometers known as Ostwald or Ubbelohde viscometers have been in existence since the early 20th century. The acidity of the extracts was measured at a temperature of T = 18.50C.

The parameters in the capillary viscometer were as follows**:** r = 0,99 mm, η_0 ($18{,}5^0$C) = 1,002 mPa.s, ρ_0 ($18{,}5^0$C) = 0,9986 g/cm^3, τ_0($18{,}5^0$C) = 14,5 sec.

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Here, η_0 – represents the aciticy of the standard substance (distilled water), ρ_0 – is the density of the standard, τ_0 – is the time it takes for water to fall and τ - the time it takes for the extract to fall.

The acidicy of the extract (η) was calculated using the following formula,

$$\eta = \eta_0 . \frac{\rho}{\rho 0} . \frac{\tau}{\tau 0}, \text{ (mPa.s)}$$

The results of the measurements are presented in Table 1 and Figure 2. It is evident from the results that the alkalinity of the homogenate is higher than that of the aqueous extract. The alkalinity of the extract is also influenced by its brewing time. Specifically, the alkalinity of the extract brewed for 24 hours was 0.0582 mPa.s higher than that of the extract brewed for 5 minutes. Interestingly, that during the synthesis of Ag nanoparticles using an extract brewed for 24 hours, the alkalinity of the solution decreases significantly upon adding the extract to the AgNO3 salt solution. This decrease is also observed when the homogenate is added

This decrease is also observed when the homogenate is added. The decrease in the alkalinity of the Ag synthesized solution may be attributed to the low alkalinity of the AgNO3 salt solution, as well as the temperature (Moradkhani, Sargsyan, Bibak, et al., 2010).

Table 1. Viscosity of Melissa officinalis leaf extracts and homogenate.

Extracts and AgNP solutions	The time of the extract falling in the capillary – τ (sec.)	Density (mPa.S)
Homogenate	14,95 ± 0,20 sec.	1,0242
Lemon balm extract -5 minutes	14,195 ± 0,02 sec.	0,9527
Lemon balm extract -24 hours	14,5775 ± 0,08 sec.	1,0109
AgNP with 5-minute extract	13,44 ± 0,01 sec.	0,92075
AgNP with homogenate	13,884 ± 0,04 sec.	0,9528

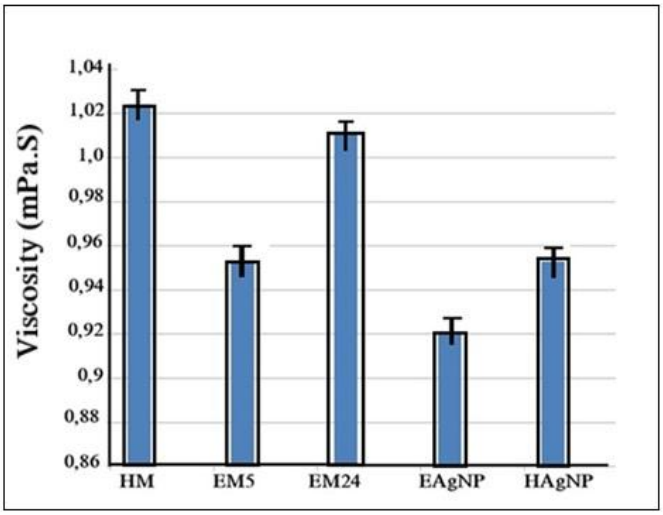

Figure 2. Desity of Melissa officinalis leaf extracts and homogenate

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Density Determination. The density of the extract and homogenate is crucial in the green synthesis of nanoparticles. The extract contains biologically active compounds in varying concentrations, which are reflected in its density. Therefore, knowing the density of the extract and homogenate is essential for controlling the nanoparticle synthesis process. Density is typically measured expressed in grams per milliliter (g/ml). To determine the density of extracts and homogenate from Melissa officinalis leaves, a known volume was measured and weighed. A 10 ml sample of the extract and homogenate was taken, and its mass was accurately measured. Once the mass is known, the density can be calculated using the formula [$\rho_b = m_b/V$**].**

where: ρ_b – density of the extract or homogenate, m_b - mass of extract, **V**-volume, the unit of density will be **g/ml**.

The results of the measurements are presented in Table 2 and Figure 3. It is evident from the results that the density of the extract after a brewing for 5 minutes is slightly higher than that of the homogenate.Additionally, the density increases as the brewing time is extendet. Hoüever, the density of the solution decreases after the synthesis process of nanoparticles, which involves adding the extract and homogenate to the AgNO3 salt solution.

Table 2. Density of Melissa officinalis leaf extracts and homogenate.

Extracts and AgNP solutions	Density of solutions (g/ml)
Homogenate	0,99 ± 0,001
Lemon balm extract -5 minutes	0,971 ± 0,002
Lemon balm extract -24 hours	1,002 ± 0,003
AgNP with 5-minute extract	0,99 ± 0,001
AgNP with homogenate	0,992± 0,002

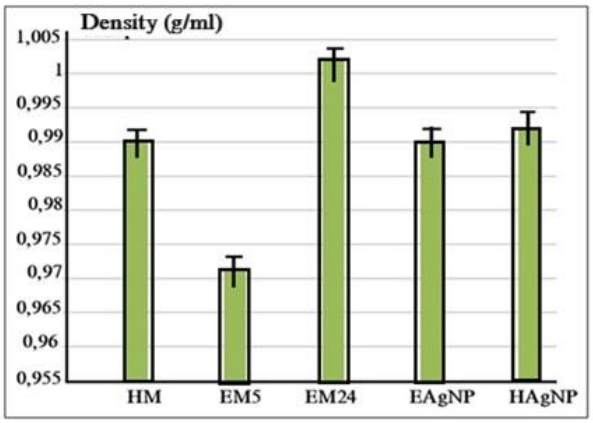

Figure 3. Density of Melissa officinalis leaf extracts and homogenate

Surface Tension Measurement. The surface tension of extracts and homogenates was determined using on the droplet hanging method. Before conducting the measurements, the density of the analyzed extracts and homogenates was measured at the dispensing glass tube's diameter (outer diameter 0.14 mm). To ensure accuracy, 60 drops were measured for each solution were repeated three times. The

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compined mass of the 60 drops and in three repetitions was 39.8 g, 39.5g and 39.7 g, respectively. The mass of the drops was calculated determined by subtracting the mass of the empty glass tube (36.7 g) from the total mass. The surface tension was then calculated at room temperature (23^0C) using the provided formula, with the unit represented as N/m.

G = mg/1,24 π r

Here, **G** is the surface tension, **m** is the mass of the droplet, **g** is the acceleration of free fall, and **r** is the radius of the glass tube (Wake, Court, Pickering, et al., 2000).

Table 3. Surface tension values of Melissa officinalis leaf extracts and homogenate.

Extracts and AgNP solutions	Mass of extract and homogenate droplets (g)	Surface tension (N/m)
Homogenate	2,97 ± 0,01 g	53,3953± 0,03
Lemon balm extract -5 minutes	6,37 ± 0,01 g	114,5213± 0,05
Lemon balm extract -24 hours	5,13 ± 0,01 g	92,2283± 0,03
AgNP with 5-minute extract	5,37 ± 0,47 g	96,5431± 0,02
AgNP with homogenate	5,07 ± 0,01 g	91,1496± 0,04

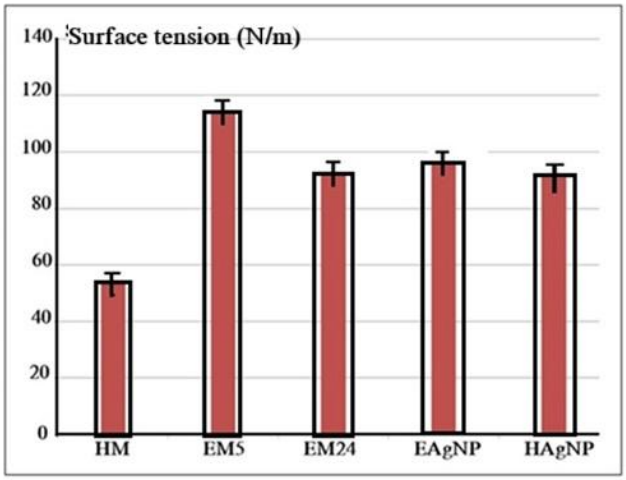

Figure 4. Surface tension values of Melissa officinalis leaf extracts and homogenate.

The results of the measurements are provided in Table 3 and Figure 4. It is evident from the measurement results that the surface tension coefficient of the homogenate is lower than that of the extracts. The highest surface tension value was observed in the extract brewed for 5 minutes. As the brewing time increases, the surface tension value of the extract decreases. It is important to note that no significant change in surface tension is observed in the solution where nanoparticles are synthesized by adding the extracts and homogenate to the AgNO3 salt solution (Allahverdiyev, Duran, Ozguven, et al., 2004).

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pH Determination. The pH values of extracts and homogenates crusial factors that affect the nanoparticle synthesis process. To achieve successful green synthesis of nanoparticles, it is essential to determine the pH values of the extracts and homogenates before adding them to the AgNO3 salt solution. In our experiments, we determined the pH values of the extracts and homogenates prior to synthesizing Ag nanoparticles. The results are presented in Table 4 and Figure 5. We observed that the pH of the solutions influenced by temperature, and the pH of the extracts and homogenates is similar. However, when added to the AgNO3 salt solution,the pH decreases significantly. For instance, the pH of the solution containing nanoparticles synthesized with the extract brewed for 5 minutes is 3.4, much lower than that pH of distilled water. This pH decrease also occurs when homogenate is added.

Table 4. pH values of Melissa officinalis leaf extracts and homogenate.

Extracts and AgNP solutions	Temperature	pH
Distilled water	22,9^{0}C	6,58± 0,2
Homogenate	15,8^{0}C	6,75± 0,1
Lemon balm extract -5 minutes	13,3^{0}C	6,39± 0,2
Lemon balm extract -24 hours	23,6^{0}C	6,1± 0,3
AgNP with 5-minute extract	21^{0}C	3,4± 0,6
AgNP with homogenate	22,4^{0}C	4,62± 0,1

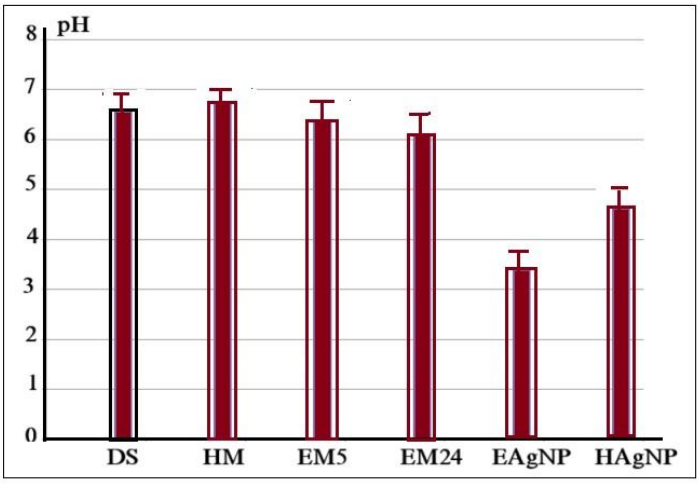

Figure 5. pH values of Melissa officinalis leaf extracts and homogenate

Determination of Electrical Conductivity. The electrical conductivity of Melissa officinalis plant extracts and homogenate was measured using a SevenCompact conductometer (Mettler Toledo, Switzerland) by immersing Electrode – LE703 electrode in the extract. Measurements were conducted in triplicate, and the results were expressed as the mean $(n = 3) \pm SD$, with the unit of conductivity being μS/cm.

The results of the measurements are presented in Table 5 and Figure 6. It was discovered that the lowest electrical conductivity was observed in the extract brewed for 5 minutes. As the brewing time increased, the electrical conductivity of the extract also increased. The addition of extracts and

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homogenate to the AgNO3 salt solution did not significantly alter the electrical conductivity of the solution in which the nanoparticles were synthesized. However, it is important to note that despite the low electrical conductivity of the homogenate, its addition to the AgNO3 salt solution actually increased the electrical conductivity of the solution in which the nanoparticles were synthesized. This could be atributed to the high conductivity of the solution during synthesis, incomplete reduction of the AgNO3 salt ions of the presence of NO3 anions.

Table 5. Electrical conductivity values of Melissa officinalis leaf extracts and homogenates.

Extracts and AgNP solutions ı	**Electrical conductivity** (μ_s/sm
Homogenate	51,7
Lemon balm extract -5 minutes	10,39
Lemon balm extract -24 hours	140,5
AgNP with 5-minute extract	145,3
AgNP with homogenate	116,8

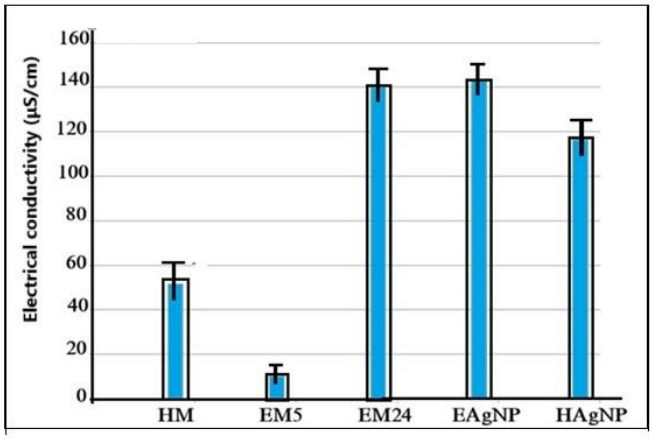

Figure 6. Electrical conductivity values of Melissa officinalis leaf extracts and homogenates

Conclusion

The conducted measurements have proven the importance of understanding the physical properties of plant extracts during their preparation and use. The results have shown that the physical parameters of extracts obtained from Melissa leaves depend on the composition of solvents, methods of extract preparation, temperature and application methods. It was observed that the physical parameters of the homogenate obtained from fresh leaves differ from those of extracts obtained from dry leaves. This distinction is particularly noticeable in the electrical conductivity and surface tension coefficient of the homogenate. Interestingly, the physical parameters also vary based on the infusion time of the extract. For instance, the electrical conductivity of the extract after 5 minutes on infusion is very low, but after 24 hours, it increases significantly. Another intriguing finding is that the physical parameters of the solution in which nanoparticles are synthesized change notably when extracts are added to the $AgNO_3$ salt solution. Consequently,this alteration is most evident in the values of basicity and surface tension. Therefore, based on these experiments, it is important to consider and adjust the physical properties of

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homogenates and extracts from leaves when utilizing them Melissa officinalis in the green synthesis of nanoparticles.

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Factors Affecting the Productivity of Cereals

Abstract

Autumn cereal sowing is preferred in all regions of Azerbaijan. Several factors influence the productivity of autumn cereals. These include: sowing time, seeding rate, irrigation, diseases, pests, and harvesting time. By carrying out all agrotechnical measures on time and combating diseases and pests effectively, it is possible to obtain high yields. Increasing the production of wheat is great importance in providing the rapidly increasing population in our country with agricultural products. In fact, one of the most important field crops in people's nutrition is wheat. Split, macarons and starch obtained from wheat flour are used in food for people, and the leaves and stem of the wheat plant are used in paper-cardboard industry and it is used for feeding animals. This study aimed to determine to the investigations carried out the factors affecting agricultural production and the relative importance of each factor in increasing the production level. The general objective of the study is to estimate crop production efficiency, determine production flexibility, and measure the effect of a factor on production wheat plant.

Keywords: *cereal, sowing, irrigation, pests, diseases, chemical control*

Introduction

The decline in biodiversity has led to a continuous increase in plant monoeciousness, which in turn has led to genetic depression, the spread of epidemic diseases, and a sharp decrease in adaptation to climatic conditions and productivity (Aliyev, 2014). According to FAOSTAT (2020), wheat is a highly productive, easily stored, and highly adaptable crop that has been cultivated in a variety of climates. From its most primitive form to the varieties currently cultivated, these and other desirable traits have been selected and developed by human societies since ancient times.

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It is thought that the domestication of wheat occurred around 10,000 years ago in the Fertile Crescent, a region in the Middle East considered the cradle of Western and Middle Eastern civilizations, and that it spread throughout the world through early farmers, adapting the domesticated populations to different environments (Seyidaliyev, Gurbanov, Mammadova, 2014).

More than 70% of agricultural land worldwide is used to cultivate cereal crops. In Azerbaijan, cereals are cultivated on an area of 900,000 hectares, of which 600,000 hectares are allocated to autumn cereals. The morphological structure of cereal plants includes the root, stem, leaf, flower, and grain (Mammadov, Ismayilov, 2012). Cereal crops have fibrous root systems that do not penetrate deep soil layers. Depending on the variety, the stems can range from 40 cm to 1.5 meters in height. The leaves are narrow and ribbon-like; the flowers form in spikes and are self-pollinating, where grains develop (Ahmadov, Musayev, 2005; Valiyeva, 2024).

Cereals occupy a prime position in the diet composition of all human beings, with rice, wheat, and maize being the major staple cereals with more than 70% share among all the food grains. Cereals are products obtained from several grain crops (Grain production, 2017; Yusifov, 2011).

Cereal grains can be classified based on their structure as either naked or hulled. Corn, rye, and wheat are considered naked grains. The structure of naked grains includes the fruit and seed coat, aleurone layer, endosperm, and embryo (Seyidaliyev, 2014). Hulled grains are surrounded by floral bracts and include barley, emmer, millet, and rice.

Research

The cultivation and production of cereals form the foundation of crop farming and are vital for the development of agriculture. In Azerbaijan, the main cultivated wheat varieties include Garagylchyg, Garabagh wheat, Sevinj, Mirbashir 50, Tartar, Mugan, Aran, Nurjahan, yellow wheat, Gurgani, and white wheat. Based on sowing time, cereals are categorized as either autumn or spring crops, with autumn cereals being more prevalent in Azerbaijani farming (Gurbanov, 2017).

The factors affecting the growth, development, and productivity of autumn cereals are divided into two categories (Devendra, 2021): 1. Uncontrollable factors: annual precipitation, temperature, floods, solar radiation, winter frosts, etc., which are beyond human control. 2. Controllable factors: sowing time, seeding rate, irrigation timing and method, fertilizer application timing and rate, pest and disease control—these are influenced by human activity (Jafarov, 2024; 2001).

Cereal crops play a crucial role in ensuring food security in our country (Seyidaliyev, Huseynov, 2020). These crops are cultivated under both irrigated and rainfed conditions across all regions, including mountainous areas. Regardless of the growing conditions, one of the key factors affecting cereal productivity is sowing time. Early sowing leads to early germination, tillering, and stem elongation, which makes the plants vulnerable to cold weather and may cause yield loss. Late sowing may also result in poor germination due to cold, leading to weaker plant development. Therefore, sowing should be carried out when the air temperature drops to +5–6°C to ensure proper tillering and winter resistance. For optimal results, sowing depth should be 8–10 cm in rainfed conditions and 5–7 cm in irrigated areas.

Another crucial factor influencing cereal yield is the seeding rate. It is essential to use high-quality certified seeds. To protect seeds from diseases, they must be treated before sowing (Khalilova, 2016). The seeding rate should be determined based on laboratory tests of seed germination and purity. It also varies depending on soil-climatic conditions and the crop variety. For example, soft wheat requires 4–5 million seeds per hectare, durum wheat 3–4 million, and barley around 3 million seeds per hectare.

Proper Calculation of Sowing Norms in Grain Crops and Its Impact on Yield

Proper calculation of the sowing rate in grain crops significantly affects high productivity. If the amount of seed sown is below the norm, sparse emergence occurs in the field, resulting in fewer plants and fewer productive stems per plant, ultimately leading to lower yields. On the other hand, if seeds are sown excessively, the field becomes overcrowded, reducing the nutrient area available per plant and

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limiting sunlight exposure. In densely sown fields, plants develop poorly and do not receive adequate nutrients. Moreover, such dense sowings promote rapid development of diseases and pests. Therefore, in winter grain crops, special attention should be given to sowing norms. These crops are vulnerable to unfavorable environmental conditions during winter and may grow weakly or even perish. That's why they require special care.

After sowing, grain seeds should be irrigated — this initial irrigation is called "sowing irrigation." Generally, grains are irrigated using the furrow method. Irrigation is especially important in winter grain crops. When precipitation is low in winter, irrigation becomes essential. Proper and timely irrigation increases productivity in grain fields. In early spring, applying nitrogen fertilizers to winter grains that have emerged from winter dormancy is crucial (Seyidaliyev, 2016). During winter, protein levels in winter grains increase, helping the plants withstand cold conditions. However, in spring, this protein hinders the formation of productive stems, so nitrogen fertilization is necessary. Fertilization plays a vital role in achieving high yields in winter grains. Applying mineral fertilizers promotes normal growth and development of the crops and enhances their resistance to diseases, pests, drought, and frost.

During the spring months, before the formation of spikes, top-dressing fertilizers should be applied. Early fertilization increases the number and formation of spikelets in the spike, laying the foundation for higher yields. Even if sowing irrigation is performed, if winter is dry, further irrigation becomes necessary. The timing of irrigation affects productivity. Depending on rainfall during the growing season, grain fields may need irrigation 3–5 times. In general, the moisture level of fields sown with winter grains should not drop below 70–75%.

During the tillering stage, a large amount of sugar accumulates in the nodes and leaves, enhancing cold resistance. Well-tillered crops in autumn absorb moisture and nutrients quickly in early spring, grow rapidly, and become resistant to spring drought.

The application of mineral fertilizers plays a significant role in achieving high-quality and high-yield winter grains. It is known that the application of fertilizers depends on the previous crop, soil structure, and composition. Applying mineral fertilizers supports the healthy growth and development of grains, increases their resistance to adverse conditions, and improves soil fertility, structure, and physical, chemical, and biological properties, which in turn boosts crop yield and quality (Gasimov, Aliyeva, Tahirli, Abduyeva-Ismayilova, 2010).

In cultivating winter grains, especially wheat, barley, and rice, the use of MAP (Mono-Ammonium Phosphate) fertilizer is recommended. MAP contains 11% nitrogen, 48–55% phosphorus, 2% CaO, and 0.5% MgO — all of which dissolve easily in water. Before applying this fertilizer, a soil test should be conducted, and MAP should be applied if these nutrients are deficient. MAP enhances root system development and strengthens plant roots, boosts flowering, and ultimately increases yield.

The quality of harvested grains depends on their genotype, growing conditions, and agrotechnical methods. With proper agrotechnology, healthy seeds with high quality indicators can be obtained. Healthier seeds lead to fewer diseases and pests in the field.

Global atmospheric changes have caused some diseases, particularly rust, to spread rapidly in winter grains. Mild winters, high early spring rainfall, and sudden temperature increases lead to the spread of rust diseases. The most dangerous diseases in cereals are yellow and brown rust, loose smut, covered smut, and powdery mildew. Yellow rust, caused by Puccinia striiformis West., affects leaves, spikes, and sometimes the grains. It causes yellow linear spots on the leaves, where uredospores mature and spread via wind, infecting healthy plants. These spores destroy chlorophyll and cause leaf drop, reducing productivity.

Loose smut is caused by Ustilago tritici, which damages mainly wheat grains. Inside the grains, black dusty masses (chlamydospores) form, which can remain viable for up to 5 years and survive in

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soil or on seeds through winter. The spores infect the spikes during flowering, destroying the developing grains (Valiyeva, 2024).

Covered smut, caused by Tilletia caries, is transmitted by wind and insects. It forms dense masses inside the grains, reducing their quality. Powdery mildew is caused by Erysiphe graminis and is seen in barley, wheat, rye, and triticale. It can infect leaves, stems, and even flowers. This disease spreads rapidly when humidity exceeds 80% and the air is cool. Root rot is caused by Fusarium graminearum, affecting all plant organs. Infected grains are light, white, and have low germination ability. To increase resistance, phosphorus-potassium fertilizers are recommended before sowing and nitrogen fertilizers after emergence.

To prevent these diseases, the following measures should be taken:

1. Crop rotation; 2. Field weeding; 3. Seed treatment (Tiram, Vitavax 75% preparations); 4. Field spraying with chemical agents.

In the experimental nursery at ADAU, we observed the spread of rust disease in soft wheat varieties such as Nurcahan and ADAU 100. Initially, we sprayed the fields with the fungicide Decotan. We monitored the field every 3 days and noticed the disease was progressing. Then we treated the field with Ridomil. Three days after application, further monitoring showed no disease progression. Ridomil also proved effective against other diseases.

Timely harvesting is essential for preserving yield. If harvesting is done too early, the grain moisture is high, leading to surface wrinkling as the grains dry, which can cause molding and spoilage during storage. If harvesting is delayed, grains begin to fall from the spikes, leading to yield loss. Therefore, special attention should be paid to timely harvesting.

To determine whether cereals are ready for harvest:

1. All plants in the field should be completely yellow.
2. Grains in the spike should be completely dry and not crushable by hand.
3. All vegetative organs (stem, leaves, spikes) should be completely dry.
4. When crushed, grains should fall easily from the spike.
5. Spikes across the field should be uniformly dry.
6. Even if dry, grains should be spread out post-harvest for additional drying.
7. Well-dried grains should be bagged and stored in dry warehouses.
8. Storage areas must be regularly ventilated.

Conclusion

The soil and climate conditions in our republic are different, the crops sometimes remain undeveloped and sometimes are completely destroyed due to the cold weather in winter. Accordingly, the demand of crops (wheat, barley, etc.) according to soil and climate conditions should be valued in a timely manner and properly. As a result, the number of plants destroyed in the winter season decreases, the plant develops well and the productivity is high. It is more important to practice the positioned team in line with other requested managers. Rotary crops should be applied properly so that, unlike other agricultural fields, the productivity is high and the productivity of the land is increased.

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Fungi Damaging Ornamental Plants in Absheron and Their Control

Abstract

Ornamental plants on the Absheron peninsula play an important role in urban planning, ecological balance and aesthetics. However, in recent years, fungal diseases that have spread to these plants have seriously affected their health and appearance. This article examines the distribution, symptoms and control methods of the main phytopathogenic fungi such as Fusarium oxysporum, Rhizoctonia solani, Botrytis cinerea, Alternaria alternata and Sclerotinia sclerotiorum. As a result of field observations and laboratory analyses conducted in Baku, Khirdalan, Sumgayit and surrounding settlements in 2024, it was determined that these fungi are closely related to climatic and agrotechnical conditions. Various control strategies were tested and it was determined that the most effective result is achieved with integrated control measures.

Keywords: *Absheron, ornamental plants, fungal diseases, plant protection, Fusarium oxysporum, integrated control*

Introduction

Ornamental plants act as an important component in modern urban infrastructure. These plants, which have functions such as aesthetic appearance, dust and noise reduction, oxygen production and microclimate regulation, are especially widespread on the Absheron Peninsula. The climatic conditions of this region - characterized by semi-desert, windy and saline soil - create both advantages and difficulties for the cultivation of ornamental plants.

In parallel with the increase in cultivated areas, the spread of phytopathogenic organisms, especially fungal diseases that pose a threat to plants is observed. These pathogens both reduce the aesthetic value of plants and weaken their biological durability and productivity. Although previous studies have provided detailed information about fungal diseases found in agricultural plants, relatively little space has been devoted to such studies in the field of ornamental plants. The main purpose of this article is to systematize fungal diseases found in ornamental plants on the Absheron peninsula, identify factors affecting their spread and evaluate control measures (Beibutov, 1965).

Research

The study was conducted in parks, private gardens and ornamental plant nurseries located in Baku city and surrounding regions – Bilgah, Mardakan, Khirdalan, Sumgayit and Masazir – from March to October 2024. A total of 120 symptomatic plant samples were collected. These plants included petunias, roses, begonias, geraniums, lavender and ornamental grasses (Porchinsky, 1911).

The collected samples were sterilized with 70% alcohol, then planted in Potato Dextrose Agar (PDA) medium and incubated at 25°C for 7 days. Colonies were identified based on their morphological characteristics under a microscope, and selected isolates were molecularly confirmed by PCR analysis of the ITS region (Mammadov, 2004).

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The following indicators were recorded at each observation site:

- ✓ Air temperature and relative humidity
- ✓ Soil pH level
- ✓ Irrigation frequency and drainage status
- ✓ Plant spacing and shading level.

Disease Indicators:

Disease Incidence (DI): The ratio of infected plants to the total number of plants.

Disease Severity Index (DSI): Rated on a 0–5 point scale (Ben-Yehuda, Assael, 2000)

The correlation of environmental parameters with diseases was statistically evaluated. The following conditions were associated with higher disease prevalence (Moiseeva, Polyakova, 1970):

- ✓ Botrytis cinerea was more prevalent in areas with humidity above 60%.
- ✓ Rhizoctonia solani and Fusarium oxysporum were dominant in areas with daily and intensive irrigation.
- ✓ Alternaria alternata spot was observed in densely planted, poorly lit areas.
- ✓ Sclerotinia sclerotiorum was more common in areas with soil pH between 6.5-7.0.

The following control methods were applied for testing purposes:

Agrotechnical measures: Proper irrigation, soil loosening, burning of infected plants.

Chemical preparations: Systemic fungicides containing azoxystrobin, tebuconazole, mancozeb (Meyer, 1933-1936).

Biological means: Soil treatment with Trichoderma harzianum culture.

Integrated approach: Complex application of all the above methods.

At the end of 6 months, the disease severity was as follows:

Group	Infection Rate	Main Result
Integral Control	12%	Most effective result
Chemical Control	42%	Temporary effectiveness
Biological Control	29%	Long-term effect
Agrotechnical	37%	Medium effectiveness
Control	78%	High infection

These results showed that through an integrated approach, it is possible to both prevent diseases and protect the environment. Chemical intervention, however, only provides short-term effects and is not sufficient for sustainable control (Rubtsov, 1948).

The issue of protecting ornamental plants on the Absheron Peninsula is important for the development of urban planning and ecology. This article is aimed at investigating the main fungal pathogens that damage ornamental plants and methods of combating these diseases. The purpose of the study is to study the nature of fungal diseases prevalent in Absheron, identify the factors contributing to their spread, and propose effective control methods. The results of the study showed that various fungal pathogens are closely related to the specific climatic conditions of Absheron and pose serious threats to the health of ornamental plants in this region (Muradov, 2019).

The study is based on field observations conducted in various residential areas such as Baku, Sumgayit, Khirdalan, Bilgah, Mardakan between March and October 2024. During these observations, 120 ornamental plant samples were collected and the reactions of these plants to fungal diseases were evaluated in laboratory conditions. The data obtained showed that the main fungal pathogens such as Fusarium oxysporum, Rhizoctonia solani, Botrytis cinerea, Alternaria alternata, and Sclerotinia sclerotiorum caused a greater spread of ornamental plants (Balakhanova, 2024, p. 40).

The results of the study showed that these pathogens cause various disease symptoms. Fusarium oxysporum and Rhizoctonia solani cause root rot and plant weakening, while Botrytis cinerea causes especially flower diseases. Alternaria alternata causes brown spots and dry rot on leaves, while Sclerotinia sclerotiorum is associated with swollen root rot of plants. The results of the study also show

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that environmental factors, especially humidity and soil drainage conditions, play an important role in the spread of fungal diseases (Shapiro, 1960). The spread of fungal pathogens is accelerated in areas of Absheron with particularly high humidity and poor drainage. Also, the pH level of the soil and the irrigation regime are important factors in the spread of these diseases. These results show that the climate and agrotechnical conditions of Absheron promote the development of fungal diseases, which highlights the importance of applying appropriate control methods (Valiyeva, Hasanova, 2022).

The effectiveness of control methods was analyzed in the study from various aspects. The integrated control approach (IPM) was evaluated as the most effective strategy. This approach involves combining chemical, biological and agrotechnical measures. The chemical control methods used in the study, especially fungicides containing azoxystrobin and tebuconazole, showed a 50%-55% reduction in the spread of diseases. However, it is known that chemical control has a temporary effect and can negatively affect the ecosystem (Balakhanova, 2024).

Biological control methods, especially the application of biological agents such as Trichoderma harzianum, have achieved more long-term and environmentally friendly results. This biological agent has helped to protect plant health by destroying pathogens in the soil. Biological control methods have had a more sustainable and environmentally friendly effect compared to chemical control (Shapiro, 1960). Agrotechnical measures, especially proper irrigation and soil aeration, have helped to prevent the spread of fungal diseases. For example, the number of fungal pathogens has significantly decreased in properly drained soil and in areas with low humidity. Correct adjustment of the distance between plants and regular cleaning of damaged plants have also helped to reduce the spread of diseases (Toth, Schmera, Imrei, 2004).

One of the main conclusions of the study is to emphasize the importance of an integrated control approach. The combined application of various control methods not only reduces the spread of diseases, but also protects the ecology. An integrated control approach is also effective against the emergence of resistance of fungal pathogens, since this approach, by combining various methods, prevents the multiplication of pathogens and reduces their susceptibility to them. The application of integrated control strategies also helps to maintain plant health and create positive effects in the field of urban development. For example, the joint cultivation of different plant species and the parallel application of several control methods improves the health of plants in urban parks and gardens (Abdumutalliyeva, Sarimsagova, 2016).

Conclusion

Future research should be directed to the development of more effective biological control methods that are suitable for the specific climatic conditions of Absheron. Also, the application of integrated control approaches on a larger scale can play an important role in the prevention of fungal diseases. It is important to test biological agents and natural control methods, taking into account the impact of chemical preparations used in Absheron on the ecosystem (Mamedov, 2004).

In addition, it is recommended to develop and implement special control strategies for ornamental plant areas located in the Absheron region. This will help both protect the ecology and make plant protection more effective.

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Soy in the Fight Against Obesity: Does it Help to Reduce Weight?

Abstract

Fighting obesity is a global challenge that requires changes in lifestyle, diet, and physical activity levels. In this article, the study of healthy foods such as soy plays an important role, as it can help control body weight and improve metabolism - presenting soy as a weight loss product.

Soybeans are a valuable crop with a high protein and oil content, which is of great importance in the food, feed and technical industries. Its cultivation requires a warm climate, fertile soils, adequate moisture and balanced mineral nutrition. Optimal agrotechnical conditions ensure high yields and improved seed quality, which is especially important for processing into food products, including soy proteins used in diets to control body weight. The role of dietary soy protein in obesity.

The aim of the study is to evaluate the effects of soy products on weight loss and their role in regulating metabolism. The main findings indicate that soy products, due to their high protein content, low fat content and carbohydrates, can contribute to weight loss, improve lipid profile and appetite control. Key research results confirm that replacing animal proteins with soy products can speed up the weight loss process, reducing the calorie content of the diet and improving the feeling of satiety. However, the effect of soy products may vary depending on the individual characteristics of the body and the methods of their processing.

Keywords: *Soy, weight loss, metabolism, soy proteins, isoflavones, low-calorie diet, lipid profile, satiety, soy processing, metabolism*

Introduction

Definition of obesity and its prevalence in the world.

Obesity is a chronic disease characterized by excessive accumulation of adipose tissue in the body, which can negatively affect health. The main criterion for the diagnosis of obesity is the body mass index (BMI), the ratio of body weight (kg) to the square of height (m2). According to the World Health Organization (WHO):

BMI 25-29.9 is overweight.

BMI ≥30 is obese.

BMI ≥40 is morbid obesity (severe form).

Obesity has reached global epidemic proportions. According to WHO (Zhang, Ho, 2005).

In 2022, more than 1 billion people in the world were obese, including about 650 million adults. Every third adult is overweight. 39 million children are obese in childhood (under 5 years old), and

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more than 340 million among adolescents (5-19 years old). Obesity is more common in high-income countries, but in recent decades there has been an increase in rates in middle- and low-income countries (Shurtleff, Aoyagi, 2007).

Factors contributing to obesity

1. An overabundance of calories in the diet is the consumption of high–calorie foods rich in fats and sugars.

2. Sedentary lifestyle – reduced physical activity due to urbanization, office work, and technology development.

3. Genetic predisposition – certain genes can contribute to fat accumulation.

4. Hormonal and metabolic disorders – thyroid gland malfunction, insulin resistance.

5. Psychological factors – stress, emotional overeating, depression.

6. Environmental impact – availability of junk food, fast food advertising, lack of fresh vegetables and fruits in the diet.

Obesity is associated with many serious diseases, including: type 2 diabetes, hypertension and heart disease, cancer, osteoarthritis, sleep disorders (apnea).

Botanical characteristics

Soy (Glycine max) is an annual herbaceous plant from the Legume family (Fabaceae). It is widely cultivated as a food, fodder and industrial crop due to the high protein and oil content in the seeds.

Research

The root system is rod–shaped, well-branched, with nitrogen-fixing nodule bacteria (Rhizobium japonicum), which allows soybeans to enrich the soil with nitrogen. The stem is erect or curly, ranging in height from 30 cm to 2 m, depending on the variety. The leaves are compound, threefold, and covered with fine hairs. The flowers are small, white or purple, gathered in racemose inflorescences. The fruits are beans 3-7 cm long, containing 2-4 seeds. The seeds are rounded or oval, the color varies from yellow to black, depending on the variety.

Soybeans are one of the world's leading agricultural crops, which has wide application and is a universal crop raw material. The food value lies in the fact that soy is used in the production of soybean oil, milk, flour, soy protein, tofu and fermented foods (miso, tempeh). As a fodder crop, soy flour and cake are obtained from it, which is used in the production of animal feed. The use of soy in feed production improves weight gain, increases productivity and reduces the cost of protein additives in animal feed. The technical use lies in the fact that soy is used in biofuels, cosmetics, pharmaceuticals. As an important agricultural crop, soybeans are of great agrotechnical importance, and as a soil–improving crop, soybeans increase soil fertility due to their nitrogen-fixing properties.

Optimal growing conditions

Soybeans are a thermophilic crop and require certain conditions for high yields.

The optimal temperature for seed germination is 13-16°C, for growth and development 20-25°C. It does not tolerate frost, the minimum temperature for growth is not lower than 10 °C. The sum of active temperatures during the growing season should be 2500-3000 °C. Soybeans prefer fertile, well-aerated soils with a neutral or slightly acidic reaction (pH 6.0–7.0). Chernozems, gray soils, sandy loams and loams are considered the best. It is sensitive to salinity and stagnation of moisture. Soybeans are a short–day crop that requires sufficient sunlight to form a crop. The greatest need for moisture is during the flowering and formation of beans. The optimal amount of precipitation is 500-700 mm per season. It reacts well to irrigation, especially in arid areas. The main macronutrients are nitrogen (N), phosphorus (P), and potassium (K). Important trace elements are molybdenum (Mo), boron (B), and iron (Fe). Nitrogen fertilizers are used in minimal doses, since soybeans fix atmospheric nitrogen due to nitrogen-fixing bacteria infecting the roots of the plant and at the same time forming nodules on the roots.

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Agrotechnical significance of soybeans: In global agriculture, the main soybean growing regions are the USA, Brazil, Argentina, China, India, Canada and Ukraine. These countries provide the bulk of the world's soybean production, which is used both for domestic consumption and for export. In Azerbaijan, soybeans are also grown in certain areas, especially in areas with favorable climatic conditions, such as Ganja-Dashkasan, Tovuz-Gazakh zone and low-lying areas of the Kur-Araz valley (Abbasova, n.d.).

The nutritional value of soybeans is due to its unique composition: on average, the seeds contain 35-40% protein, which is close to animal protein in amino acid composition, as well as 18-22% oil rich in polyunsaturated fatty acids, especially linoleic and linolenic. In addition, soy contains isoflavones, which have antioxidant and hormone-regulating properties, contributing to the prevention of cardiovascular diseases, diabetes and certain types of cancer. Its high nutritional value makes soy an important component of vegetarian and healthy diets, especially in the form of tofu, soy milk, soy texturate, and fermented foods (Masoumeh, Andrade, 2018).

Due to its agrotechnical properties, soybeans are an excellent precursor for many crops, as they fix atmospheric nitrogen in the soil, reducing the need for nitrogen fertilizers and increasing soil fertility. This makes it an important element of crop rotation, especially in regions with intensive agriculture (Messina, Messina, 2010).

The chemical composition of soybeans. Soy has a unique chemical composition that makes it a valuable food and fodder crop. On average, soybeans contain 35-40% protein, rich in essential amino acids, especially arginine, lysine and glutamic acid.

The fat content of the seeds is 18-22%, while soybean oil is rich in polyunsaturated fatty acids, including linoleic acid and linolenic acid, and also contains phospholipids, especially lecithin. Carbohydrates in soy are about 30%, the main part of which is fiber and oligosaccharides. Soy contains a wide range of vitamins (B groups, vitamin E) and trace elements such as calcium, magnesium, iron, phosphorus, zinc and molybdenum. An important biologically active group of compounds are isoflavones, which have antioxidant and hormone-like properties that can contribute to the prevention of cardiovascular diseases and certain types of cancer. The high nutritional value of soy and its balanced composition make it indispensable in the production of plant proteins and functional foods.

Relevance of the topic

The growing number of obese people is one of the serious problems of modern society, leading to an increase in cases of diseases such as type 2 diabetes, cardiovascular diseases and metabolic syndrome. Excess body weight negatively affects metabolism, provoking insulin resistance, increased cholesterol levels and blood pressure, which significantly increases the risk of heart attacks and strokes. Modern research shows that proper nutrition plays a key role in the prevention and control of obesity, and soy, due to its high protein content, low glycemic index and the presence of biologically active compounds, can help control body weight and improve metabolic health. This makes studying the effects of soy on weight loss and obesity prevention an urgent task of modern science.

The popularity of soy as a source of vegetable protein in diets for weight loss is due to its high content of easily digestible protein (35-40%), low in fat and carbohydrates, as well as the presence of bioactive compounds that accelerate metabolism. Unlike animal proteins, soy protein does not contain cholesterol and is rich in essential amino acids, which makes it an ideal component for a low-calorie diet. In addition, soy has a low glycemic index, helping to control blood sugar levels and preventing insulin spikes, which is especially important for people with metabolic disorders. Isoflavones contained in soy can have a positive effect on lipid metabolism, reducing the level of harmful cholesterol and reducing the risk of cardiovascular diseases. Due to these properties, soy products such as tofu, soy milk, tempeh, and soy protein isolate are often included in diets aimed at weight loss and maintaining a healthy lifestyle.

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Studies on the effects of soy products on fat metabolism and satiety provide mixed results. Some of them indicate the positive effects of soy protein and isoflavones on the lipid profile and appetite control, while others do not reveal significant effects.

"Soy Products Ameliorate Obesity-Related Anthropometric Parameters in Overweight and Obese Subjects: A Systematic Review and Meta-Analysis of Randomized Controlled Trials" Nutrients, 2019. This meta-analysis examined the effects of soy products on weight and waist circumference in overweight and obese people. The results showed that the addition of soy products contributed to a significant reduction in body weight and improved anthropometric indicators (Yuze, Kou, Wei, Lu, Liu, Tian, Zhang, Liu, Li, Cui, Wang, 2019).

"Effects of Soy or Whey Protein on Weight Reduction in Patients with Non-Alcoholic Fatty Liver Disease: A Randomized Controlled Trial"

Clinical Nutrition Open Science, 2023. This study compared the effects of soy and whey protein on weight loss in patients with non-alcoholic fatty liver disease. Both types of protein have shown effectiveness in reducing body weight, but soy protein has also improved the lipid profile (Michiko, Imai, Yamada, Muramae, Yoshimura, Mitomo, Bando, Sugawara, Asahara, Hirota, Tamori, Takahashi, Ogawa, 2024).

"Effect of Soy and Soy Isoflavones on Obesity-Related Anthropometric Measures: A Systematic Review and Meta-analysis of Randomized Controlled Clinical Trials"

Journal of the Academy of Nutrition and Dietetics, 2016. A meta-analysis that evaluated the effects of soy and soy isoflavones on weight, waist circumference, and fat mass. It was found that soy consumption is associated with a significant decrease in these indicators (Akhlagi, Zare, Nuripur, 2017).

"Effects of Consuming a High-Protein Diet with or without Soy Protein during Weight Loss and Maintenance: A Non-Inferiority Randomized Clinical Efficacy Trial"

Obesity Science and Practice, 2018. This clinical trial assessed the effects of a high-protein diet with or without soy protein on weight loss and maintenance. Results showed that soy protein was as effective as other protein sources for weight loss and body composition improvement (Speaker, Sayer, Peters, Foley, Peng, Wyatt, Flock, Mukherjee, Hill, 2018).

"Effectiveness of a Soy-Based Compared with a Traditional Low-Calorie Diet on Weight Loss in Spanish Overweight Adults: A 12-Week Study"

Nutrition, 2007. The study compared the effectiveness of a soy diet and a traditional low-calorie diet in overweight Spanish adults. Both diets resulted in significant weight loss, but the soy diet showed additional benefits in improving the lipid profile (Liao, Shi, Yang, Lin, Jian, 2007).

The article "Soy protein: benefit or harm?" analyzes the effect of soy protein on body weight and fat mass. A review of 40 studies found no significant positive effects of soy protein on weight loss, waist circumference, and fat mass. However, it is noted that replacing meals with soy protein resulted in an average loss of 2 kg more than the standard diet (Food and Science, 2024).

The article "Composition and medicinal properties of soy products" examines the effect of soy dietary fiber on the body. Soy dietary fiber with a low fat and sodium content has high healing properties in patients with metabolic disorders, digestive disorders, atherosclerosis and other diseases (The Manual/The team of authors, n.d.).

These studies suggest that the inclusion of soy products in the diet can be an effective approach to weight loss and improve metabolic performance, especially when combined with general dietary and physical activity recommendations.

Thus, the effect of soy products on fat metabolism and satiety remains a subject of scientific debate. Further studies are needed to more accurately determine their effectiveness in controlling body weight and improving the lipid profile.

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Soy is a popular source of plant-based protein and is often used in diets aimed at weight loss. When comparing soy with other protein products such as whey protein, it is important to consider several key aspects.

Whey protein, obtained from milk, contains all nine essential amino acids and has a high biological value, which contributes to effective absorption by the body. On the other hand, soy protein is also considered complete, but its digestibility may be slightly lower (Fitness, 2025).

Both types of protein can be effective in weight loss programs. Whey protein, due to its high content of branched chain amino acids (BCAAs), can help increase muscle mass and accelerate metabolism. Soy protein, in turn, is low in fat and cholesterol, which makes it attractive to those who seek to reduce their intake of saturated fats (Product rating, 2024).

Soy protein can help reduce cholesterol levels and improve the lipid profile, which has a positive effect on the cardiovascular system.

Research methodology

There are various studies in the scientific literature on the effect of soy on fat metabolism and satiety. Below are some of them:

"The effect of a soy-enriched diet on blood lipids, liver, and brain in rats": This study examined the effects of prolonged soy consumption on blood plasma biochemistry and lipid levels in rat organs. The results showed a significant increase in vitamin E content in the liver, which may indicate the potential antioxidant properties of soy.

"The protective effect of soy proteins on excess fat in the rat diet": A study evaluated the effect of soy proteins on arterial reactivity in rats consuming a high-fat diet. It has been found that the inclusion of soy proteins in the diet improves vascular function, which may be due to their protective effect against vascular disorders caused by excess fats (Feoktistova, Starberg, Borodin, 2018).

"Analysis of the effects of soy and soy products on the human body": This paper examines the components of soy, their beneficial and potentially harmful properties, as well as their effect on processes in the human body. It is noted that certain substances in soy can have both positive and negative effects on health, depending on the individual characteristics of the body and the amount of product consumed (Ivanova, 2024).

These studies highlight the complexity and versatility of soy's effects on fat metabolism and satiety, indicating the need for further research to better understand its effects on the body.

Analysis of the biochemical composition of soy and its components affecting metabolism.

Soy contains a wide range of biologically active substances that can affect metabolism. The main components that affect metabolism include:

Proteins and amino acids. Soy protein contains all the essential amino acids, although their proportions differ from animal proteins. Soy proteins can help lower cholesterol levels and improve lipid metabolism.

Isoflavones. These are natural phytoestrogens with antioxidant properties. They can affect blood glucose levels and reduce the risk of metabolic disorders.

Lecithin and phospholipids. These substances are involved in fat metabolism, improving the absorption of fats and preventing their excessive accumulation.

Dietary fiber. The fiber contained in soy helps improve digestion and slows down the absorption of carbohydrates, which helps control blood sugar levels.

Oligosaccharides and saponins. These components can help reduce cholesterol levels and have a positive effect on the intestinal microflora.

Thus, the biochemical composition of soy makes it potentially useful for maintaining normal metabolism and preventing diseases associated with metabolic disorders.

Comparison of the effectiveness of soy and traditional low-calorie diets.

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Comparing the effectiveness of soy diets and traditional low-calorie diets in weight loss is an urgent topic in dietetics. Both diets are aimed at reducing body weight, but they differ in composition and mechanism of action.

The soy diet involves replacing animal proteins with soy products such as tofu, soy milk, and soy texturate. This helps to reduce the intake of fats and cholesterol, which can have a beneficial effect on the lipid profile of the blood. In addition, soy is rich in isoflavones, which have antioxidant properties and can have a positive effect on metabolism. Adherents of the soy diet note its balance, food availability and lack of hunger. However, it should be borne in mind that a sharp increase in the consumption of soy products can lead to individual body reactions (The deli, 2015).

Traditional low-calorie diets are based on a general reduction in caloric intake by reducing the intake of fats and carbohydrates, while protein sources can be diverse, including both animal and vegetable products. These diets aim to create a calorie deficit, which leads to a decrease in body weight. However, long-term adherence to low-calorie diets can be fraught with difficulties, such as hunger, decreased energy levels, and the risk of nutritional deficiencies (Komshilova, Troshina, Silina, Ershova, Dzgoeva, 2024).

In general, both diets can be effective for weight loss, provided they are followed correctly and the individual characteristics of the body are taken into account. The choice between a soy diet and a traditional low-calorie diet should be based on personal preferences, food tolerance, and expert recommendations.

Possible limitations and contraindications when using soy.

Although soy is a valuable source of plant protein and other nutrients, its use may be limited or contraindicated in some cases. Here are a few possible limitations:

1. Allergy to soy:

Soy is one of the main allergens, especially among children. An allergic reaction can manifest as skin rashes, swelling, difficulty breathing, and even anaphylaxis.

2. Hormonal disorders:

Soy isoflavones have properties similar to estrogens, which can affect hormonal balance, especially in people with hormone-dependent diseases such as breast cancer or prostate cancer. It may be contraindicated in such conditions.

3. Thyroid dysfunction:

Soy contains substances that can inhibit the activity of the thyroid gland (goitrogens), especially with insufficient iodine intake. People with hypothyroidism or other thyroid diseases should limit their intake of soy products.

4. Digestive issues:

Soy can be difficult to digest for some people, especially when consumed raw. It can cause gas formation, bloating, or other digestive system symptoms, especially in people with a sensitive gastrointestinal tract.

5. Kidney problems:

Due to the high content of phytoestrogens and protein, people with kidney problems (such as those with chronic kidney disease) are advised to limit their intake of soy products.

6. The use of soy products during pregnancy and lactation:

Although limited amounts of soy are considered safe, women during pregnancy and breastfeeding should consult a doctor before including large amounts of soy products in their diet due to exposure to isoflavones.

7. Drug interactions: Soy may interact with certain medications, including blood thinners, blood sugar control medications, and hormonal medications.

Before including soy in the diet, it is important to consult a doctor, especially if a person has one of the listed conditions or diseases (Velasquez, Bhatena, 2007).

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Conclusion

Studies show that soy products can have a positive effect on weight loss due to several mechanisms. Soy is a low-fat and carbohydrate protein source that helps reduce total caloric intake. Soy proteins also help increase feelings of fullness, which can reduce appetite and help control food intake. In addition, soy isoflavones have antioxidant properties and can affect metabolism by improving the lipid profile and lowering cholesterol levels.

Some studies confirm the hypothesis of the benefits of soy products in the fight against obesity, showing that replacing some animal proteins with soy products can help reduce body weight and reduce fat mass. However, the results are not always clear, and in some cases the effect of soy products may be minimal. All this highlights the need for further research to better understand the role of soy in the weight loss process. In general, we can talk about the positive effects of soy products, but they are not a panacea and should be used as part of a balanced diet and a healthy lifestyle.

Further research should focus on the effects of different soybean varieties on weight loss, as the composition and nutritional value of the varieties may vary significantly. It is important to investigate how various soy processing methods (such as heat treatment, fermentation, or extraction) affect its properties, including protein digestibility and isoflavone content, which may affect metabolism. It is also necessary to study the long-term effects of soy products consumption as part of diets aimed at weight loss, as well as their impact on the intestinal microbiota and general metabolic processes.

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Studying the Treatment Method for Pebrine (Nosematosıs) Disease of Mulberry Silkworm

Abstract

For the first time in the conditions of the Republic of Azerbaijan, the development of medicinal treatment and preventive methods against pebrin or nosematosis disease of mulberry silkworms, which causes severe damage to silk farms, was carried out. In the research, natural sick and healthy grenae of the Namazli-2 mulberry silkworm breed with pebrin and worms hatched from them were used.

In the spring feeding of the Namazli-2 mulberry silkworm breed, fumagillin DCH, amprolium, coccidiovit and baykox preparations were used against pebrin or nosematosis disease (causative agent - Nosema bombycis).

When the naturally diseased grenae with pebrin were treated with ready-made solutions of 1.0% fumagillin DCH and 2.0% amprolium, coccidiovit, and baycox preparations and the worms were fed regular feed (without the preparation) before the first feeding, the mortality during the worm stage from pebrin disease was reduced to 17.36-16.31%, the total death to 22.22-19.99%, and the survival of the worms increased to 19.99-22.22% against the background of the disease. The cocoon yield from one standard box (20,000 pieces) of grenae was 9.2-10.6 kg higher than that of the diseased control.

Keywords: *mulberry silkworm, genus, nosematosis, natural infection, grenae, preparations, treatment*

Introduction

Since ancient times, people have used natural silk as a valuable textile material for the production of carpets, various types of clothing, bedding, and various household items (Garayev, Musayeva, Suleymanova, 2006). In modern times, natural silk, due to a number of valuable and irreplaceable properties - hygiene, elasticity, insulation, strength, fire resistance, etc., is widely used not only in the

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textile industry, but also in radio engineering and electronics, musical instruments, precision instruments and cable production, aviation and astronautics, cinematography, surgery, including eye surgery. This requires increasing the production of cocoons and raw silk in our country, along with other sericulture countries. One of the most important sources of supply for intensively increasing the production of cocoons and raw silk is the development of effective methods of combating infectious diseases of the mulberry silkworm (Garayev, Musayeva, 2009).

Like other living organisms, mulberry silkworms can contract various diseases when they are constantly interacting with external environmental factors (food, climate, sunlight, energy, microorganisms, etc.). Mulberry silkworms are susceptible to a number of infectious diseases (flascheria, septicemia, muscardina, jaundice, pebrine or nosematosis), and the occurrence of these diseases in mulberry silkworm feeds causes a loss of 10% to 100% of cocoon production in sericulture farms (Ahmadov, 2009).

Research

To date, various levels of physical, chemical, biological and enzymatic complex treatment and sanitary-prophylactic measures have been developed to combat infectious diseases of mulberry silkworms, depending on the degree to which the epizootological and biological characteristics of the diseases have not been disclosed (Ahmadov, 2010; Aliyev, 1986). Pebrin or nosematosis disease of mulberry silkworms is one of the main infectious diseases of mulberry silkworms. The causative agent of the disease (Nosema bombycis) is transmitted to the new generation with mulberry silkworm seeds (through the cocoon), and worms emerging from such a conditionally diseased cocoon infect other healthy worms during feeding, causing mass mortality in the feeding, which causes great economic damage to sericulture farms. Although it is flawed in terms of application, some work has been carried out in the field of developing some therapeutic and preventive methods to prevent Pebrin disease. Among the research works conducted in this field in the modern era, the research works conducted by affecting the cocoon and pupae of mulberry silkworms with sublethal temperatures are more important (Hajiyev, 2000; Huseynov, 2003; Garayev, Musayeva, Suleymanova, Rzayeva, 2004).

It is known from the literature (Garayev, Musayeva, Suleymanova, 2004) that the causative agent of pebrin is a spore that leads a latent (anabiosis) lifestyle in the external environment. Its development cycle begins 6 hours after the spore enters the midgut of the worm through digestion and ends in three stages (planont, meront, and spore).

As a result of the influence of external factors, the virulence of pebrin spores persists for one to eight years. In the corpse (pathological material) of a worm that died of Pebrin's disease, Nosema spores remain highly virulent for a year, weaken in subsequent years, and disappear completely after six years. The main source of the spread of Pebrin disease is sick silkworms. Because Nosema spores are spread in the external environment through the excrement of sick insects, changed shells, dead worm bodies, granae shells, etc. The secondary source of infection is considered to be feed, care items contaminated with Pebrin (spores) (Garayev, Ahmadov, 2005).

Material and method of the study. The effect of the preparations on the development of pebrin disease of mulberry silkworms was carried out in the following directions: By affecting naturally sick grenae with solutions of the tested preparations; By feeding the worms with solutions of these preparations of different concentrations against the background of natural and artificial infection; By feeding the worms with preparations as a prophylactic measure (Garayev, Musayeva, Suleymanova, Rzayeva, 2004).

In the study, naturally sick and healthy grenae with pebrin of the Namazli-2 mulberry silkworm breed and worms hatched from them were used. Some indicators of the Namazli 2 breed, created by breeders of the Azerbaijan Scientific Research Institute of Sericulture: 1. Germination rate – 86.90%; 2. Worm viability – 93.30%; 3. Feeding period – 28.7 days; 4. Mass of live cocoon – 1.73 g; 5. Silkiness of live cocoon – 23.31%; 6. Cocoon yield from one box (20,000 pieces) of grenae – 28.1 kg; The

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grenae of the Namazli 2 breed is ash-colored, sticky, the worms are spotted, and the cocoons are white and oval (Hajiyev, 2000).

Characteristics of the tested chemical preparations

1. Fumagillin DCH – (fumagillinum)

Description: A yellowish, weakly odorous, water-soluble, microgranulated powder. It is a dicyclohexylammonium salt product formed as a result of the metabolism of the fungus Aspergillus funigatus (Shafer, Williams, Shutler, 2009).

Composition: Fumagillin-dicyclohexylamine – 34 g, fillers – 1000 g. It is a specific substance for the treatment and prevention of nosematosis disease of honey bees caused by protozoa (Nosema apis Cander).

Structural formula: C16-17H25-27O3O-CO-(CH=CH)4 x COOH. Manufacturer: Budapest. Hungary.

2. Amprolium – (amprolium)

Description: White, faintly odorous, crystalline powder, easily soluble in water, methanol and 95% ethanol.

Composition: Amprolium hydrochloride – 20-25%. Application: Used against coccidiosis of all types of birds. Effective against individual coccidia: In chickens – *Eimeria tenalla, E. necatrix, E. acervulina, E. and E. praecox;* In turkeys – *E. adenoeides, E. gallapavonis and E. meleagrimitis;* In pheasants – *E. phasiani, E. colchici and E. duodenalis.*

Structural formula: *C14H20N4CL2. Manufacturer:* Poland.

3. Koksidiovit – (coccidiovitum)

Description: White, odorless, sweet-tasting, water-soluble, microgranulated powder. Composition: 1 g of the drug contains 120 mg of amprolium hydrochloride, 2 mg (Vikasol) vitamin K, 10,000 IU of vitamin A and 1 filler. *Application:* It is used for the treatment and prevention of coccidiosis in poultry. The drug is mainly effective against protozoan diseases caused by *E. tenella, E. acervulina, E. necatrix, E. maxima, E. mivati, E. brunetty* in chickens. *Manufacturer:* Poland.

4. Baycox – (baycox)

Description: Colorless, odorless liquid solution. Composition: 1 liter of the drug contains 25 g of toltrazuril. Application: The most modern and effective substance for the treatment and prevention of coccidiosis in agricultural poultry. Toltrazuril in the composition of Baycox preparation contains eimeria *(E. acervulina, E. brunetti, E. necatrix, E. mitis, E. adenoides, E. meleagrimitis, E. anceris, E. truncate, E. hagani, E. maxima, E. mivati, E. praecox, E. tenella, E. dispersa, E. gallapavonis, E. innocua, E. meleagridis, E. subrotunda, E. anseris, E. nocens, E. parvula, E. stigmosa, E. anatis, E. danailovi, E. Perniciosa, E. columbae, E. columbarum, E. labbeana)* coccidiocytes affect all stages of cell internal development. Manufacturer: Germany.

Methodology for studying the effect of preparations on pebrin disease of mulberry silkworm

Experiments were conducted in the following 2 directions to study the effect of the selected preparations on pebrin disease of mulberry silkworm: Study of the therapeutic effect of preparations against pebrin disease; Study of the prophylactic effect of preparations against pebrin disease; Study of the therapeutic effect of preparations against pebrin disease was conducted in 2 directions: By affecting naturally diseased grenae and worms emerging from this grenae with solutions of the tested preparations (by feeding them); By feeding worms artificially infected with pebrin spores with solutions of various concentrations of these preparations. In order to study the therapeutic effect of the solutions of the tested preparations on natural diseased grenae and worms emerging from these grenae, experiments were conducted in the following order: in order to study the effect of ready-made solutions of 1.0% fumagillin DCH and 2.0% amprolium, coccidiovit and the same percentage of baycox preparations on natural diseased grenae with pebrin, an appropriate amount of natural diseased grenae was taken for each variant (preparation) and placed in pre-prepared sterile bags, taken out of wintering

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30 days before spring incubation and kept in the above-mentioned concentrated solutions of the tested preparations at a temperature of 15-18^0 for 2 hours (i.e., exposed). After the diseased grenae were treated in the solution of the corresponding preparations, samples were taken from each variant in 3 repetitions, 100 grenae in each repetition, to study the viability of the grenae (Garayev, Musayeva, Suleymanova, 2008). At the same time, in the experiment, natural healthy grana were treated with ordinary water (distilled) and 3 samples of 100 grenae were taken in each replicate to study their resuscitation ability. After that, the grenae treated in the drug solution were put back in the refrigerator and after 30 days were taken out and the grenae treated with each drug were divided into 10 variants, incubated and revived. The worms that emerged from the diseased grenae were fed with mulberry leaves soaked in different concentrations of each drug solution according to their ages, 1, 2 and 3 times a day (morning, afternoon, evening) (Pasteur, 1870). When the ready-made solution of the drugs was mixed with feed and fed to the worms, 2 ml of the corresponding drug solution was used for every 100 worms per 10 g of freshly chopped mulberry leaves. Mulberry silkworms were fed with preparations starting from the first feeding. The worms were given intermediate feeds in the usual way. Feeding the worms with the solution of the appropriate preparations was continued together until the 2nd day of the III age, and from the 2nd day, in 3 repetitions according to the variants, with 150 worms in each repetition, until the end of the IV age (until the 4th sleep). In the experiment, mulberry silkworms were fed with ordinary feed (without preparations) from the 1st day of the V age to the end (Vereiskaya, Astaurov, Bednyakova, 1958).

Conclusion

The following conclusions were drawn based on the first-ever medicinal treatment and prophylactic research conducted against pebrin disease of mulberry silkworms in the Republic of Azerbaijan and the biometric analysis of the obtained indicators: Each of the fumagillin DCH, amprolium, coccidiovit and baycox preparations used against pebrin or nosematosis disease (causative agent - Nosema bombycis) in spring feeding of the Namazli-2 mulberry silkworm breed, depending on its concentration and daily application intensity, has a therapeutic effect on pebrin disease to one degree or another.

When the naturally diseased grenae with pebrin are affected with ready-made solutions of 1.0% fumagillin DCH and 2.0% amprolium, coccidiovit, baycox preparations and when the worms are given regular feed (without the preparation) before the first feeding, the mortality during the worm stage from pebrin disease decreases to 17.36-16.31 absolute %, the total mortality decreases to 22.22-19.99 %, and the survival of the worms increases to 19.99-22.22 % against the background of the disease. The infection rate in butterflies decreases to 59.52-48.93 absolute %. The cocoon yield from one standard box (20,000 pieces) of grenae is 9.2-10.6 kg higher.

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Biomorphological Characteristics of Helminths Parasitizing Poultry in the Western Region of Azerbaijan

Abstract

Studies were conducted in recent years in individual and farm poultry farms of Aghstafa, Dashkasan and Gadabay districts of the Western regions of Azerbaijan.

The species composition of helminths parasitic in poultry kept in the farms in the region was determined based on helminthological sputum examination of 280 domestic geese, 352 ducks and 668 chickens of different age groups. Also, in order to determine the level of spread of helminthosis in farms and the extensiveness of invasions, 870 cal samples were taken from geese, 946 cal samples from ducks and 1260 cal samples from chickens kept in the farms where the studies were conducted and helminthoscopic examination was performed.

Examinations were conducted using the helminthological sputum method of K.I. Skryabi. As a result of the sputum examinations, helminths were collected from 786 individuals from geese, 909 individuals from ducks and 1215 individuals from chickens. The species composition of the collected helminths was investigated and specified based on specific helminth determinants. According to the results of helminthological sputum and helmintoovoscopic examinations, it was determined that ducks and geese in farms were parasitized by cestodes - Fimbriaria fasciolaris and Drepanidotaenia lanceolata, trematodes - Echinostoma revolutum, Echinoparyphium recervatum and nematodes - Capillaria anseris, Amidostomum anseris, Ganguleterakis dispar, and chickens were parasitized by cestodes - Railletina tetragona, nematodes - Capillaria obsignata, Ascaridia galli and Heterakis gallinarum.

Keywords: *type, gender, goose, duck, trimatode, cestode*

Introduction

Primarily epizootiological studies have been conducted in Azerbaijan regarding certain helminths and helminthiases of domestic birds. However, this information does not fully reflect the current epizootiological situation in modern poultry farms (Aghayeva, 2018). One of the main objectives of the conducted research was to study the systematics and biomorphological characteristics of parasitic helminths prevalent among domestic birds in the western region of Azerbaijan. Moreover, the use of the most modern technologies in various types of farms and private households, which differ in terms of keeping, breeding, and feeding conditions, highlights the importance of applying more advanced, modern, and economically efficient methods for the treatment and prevention of possible diseases (Musayev, Hajiyev, Yolchuyev, Vahidova, Mustafayeva, 1991).

Research

In recent years, studies have been conducted in individual and farm-based poultry enterprises located in the western regions of Azerbaijan, specifically in the districts of Aghstafa, Dashkasan, and Gadabay. It should be noted that these areas are rich in freshwater bodies, including rivers and small lakes, which make it possible to keep domestic waterfowl in these regions (Bayramova, 2023).

The species composition of helminths parasitizing domestic birds in the farms of this region was determined based on helminthological dissection of 280 domestic geese, 352 ducks, and 668 chickens

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belonging to different age groups. Additionally, in order to determine the prevalence of helminthiases and the extent of invasions in these farms, 870 fecal samples from geese, 946 from ducks, and 1260 from chickens were collected and examined using helminthoovoscopic methods (Hajiyev, Aliyev, Aliyev, 1989). Examinations were carried out using K.I. Skryabin's helminthological dissection method (Mammadov, Hajiyev, Shirinov, Aghayev, 1986). As a result of the dissections, 786 helminths were collected from geese, 909 from ducks, and 1215 from chickens. The species composition of the collected helminths was analyzed and identified based on specific helminth identification keys (Nasirov, Gaziyev, Bunyadova, 2010).

When analyzing the results of helminthological examinations conducted in individual and farm poultry farms of Dashkasan, Aghstafa and Gadabay regions, it was found that various helminth species were parasitic (Bayramova, 2024). According to the results of helminthological examinations and helmintoovoscopic examinations, it was determined that ducks and geese in the farms were parasitized by cestodes - Fimbriaria fasciolaris and Drepanidotaenia lanceolata, trematodes - Echinostoma revolutum, Echinoparyphium recervatum and nematodes - Capillaria anseris, Amidostomum anseris, Ganguleterakis dispar, and chickens were parasitized by cestodes - Railletina tetragona, nematodes - Capillaria obsignata, Ascaridia galli and Heterakis gallinarum (Bayramov, 2010). It is a type of parasitic class that is widespread in the western region Cestoidea (Rudolphi, 1808) Drepanidotaenia lanceolata (Bloch, 1892) (Bayramova, 2014).

During helminthological examinations of the intestines, this cestode was found in the small intestine of geese and ducks up to 6 months of age. The prevalence of the cestode in the intestines of waterfowl was 3-9 individuals in geese (average intensity index 3.5 individuals) and 2-7 individuals in ducks (average intensity index 2.9 individuals). The length of the light yellow D.lanceolata cestode was 11-20 cm, and the width of the last, hermaphrodite joints reached 1-1.2 cm. The scolex of the helminth contained 4 suckers, and around them 8 hooks. The head, which is pear-shaped, has dimensions of 0.25-0.18 mm, and passes into the neck with the first joints. The growth of the cestode occurs due to the joints in the neck. In the 8-10 joints after the neck, the male and female genital organs are located, the ducts of which open together. Depending on the development of the joints, numerous follicles are located in the elongated ovipositors located in them. The last joints contain the brood, which is filled with eggs. The oval-shaped egg of the cestode is covered with a very delicate 4-layer membrane (Agaeva, 2014).

Drepanidotenia are biohelminths that develop with the participation of intermediate hosts - cyclops, water snails, crustaceans. The last segments filled with eggs are excreted from the intestines of waterfowl through the feces and are swallowed by crustaceans when they fall into the water. At an ambient temperature of 18-200C, invasive cysticercoids develop from eggs in the body of the intermediate host in 10-12 days. When waterfowl eat crustaceans, cysticercoids are released in their digestive system, attach to the intestinal wall, and develop there for 12-18 days, reaching the imaginal stage.

In the conducted helminthological examinations, the prevalence of the cestode, which was mostly found in the small intestines of ducks and geese up to 3-6 months of age, was 1-3 individuals in geese (average intensity index 1.5 individuals) and 3-9 individuals in ducks (average intensity index 3.6 individuals). Fimbriaria fasciolaris is a thread-shaped cestode with a strobila length of 22-35 cm and a width of 1-3 mm. The scolex contains 10 alternately arranged suckers and hooks, which serve to firmly fix the cestode to the intestinal wall of the bird. The diameter of the suckers reaches 0.04-0.5 mm. The hermaphrodite joints contain alternating gonads. Inside the last joints of the cestode, pear-shaped oncospheres are filled with eggs (Amirov, Mullayarov, 2015)

Intermediate hosts - cyclops, cephalopods, crustaceans - play a key role in the development of fambriaria. The last segments filled with eggs are excreted from the intestines of waterfowl through the feces and are swallowed by crustaceans when they fall into the water. When the water temperature is

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22-240C, the invasive cysticercoid larva develops from the egg in the body of the intermediate host in 6-17 days. At lower temperatures, the development of the larva in the body of the intermediate host can last up to 30-32 days. When waterfowl eat crustaceans, cysticercoids are released in their digestive system, attach to the intestinal wall, and develop there for 8-11 days, reaching the imaginal stage. Fambriaria can live in the intestines of birds for 8-10 months.

During the research, helminthological examinations of chickens revealed the cestode Railletina.tetragona in their small intestines. The distribution of the cestode, which was observed more intensively mainly in chickens aged 6 months to one year, was 3-14 individuals (average intensity indicator 4.6 individuals). The strobila of the cestode R.tetragona is 10-25 cm long and 1-5 mm wide. The oval scolex has a diameter of 0.25-0.45 mm, and on the proboscis there are up to 100 rows of suckers and hooks, which play a key role in the fixation of the helminth on the intestinal wall. The gonads are located unilaterally in the hermaphrodite joints. The adult larva, located inside the hermaphrodite joints, contains 6-12 eggs collected in a special capsule. The diameter of the eggs reaches 0.0025 - 0.0050 mm.

Enter the external environment with the feces of chickens. Ants eat the last joints of the cestode R. tetragona or carry them to their nests and feed their larvae. In the body of insects, cysticercoids emerging from the helminth larvae undergo a double phase. Depending on the temperature (24-260C), the development of cysticercoids in ants is completed in 43-46 days. When chickens eat ants with invasive cysticercoids inside, the cysticercoids released in the digestive system attach to the intestinal wall with their hooks and suckers and turn into adult helminths in 2-3 weeks. The life span of the cestode in the intestine of a bird lasts 2-3 months. Sometimes, the cestode loses its strobila, spends the whole winter in the intestine, and in the spring it can resume its development by forming joints again.

In the helminthological examinations conducted, the prevalence of the trematode E. revolutum, which was mostly found in the small intestines of ducks and geese up to 3-6 months of age, was 1-5 individuals in geese (average intensity index 2.8 individuals) and 1-9 individuals in ducks (average intensity index 5.1 individuals).

The length of adult individuals of the trematode E. revolutum is 6.8-12 mm, and the width is 0.9-2 mm. There are numerous teeth on the cuticle in the anterior part of the body. 35-40 such spines are arranged on the collar surrounding the oral sucker. The diameter of the oral sucker is 0.138-0.341 mm, and the diameter of the abdominal sucker reaches 0.68-1.32 mm. In the lower part of the body, next to each other, there is an oval-shaped genital bursa and a spherical ovary. The ventral part of the body of the helminth is occupied by a brood cavity filled with eggs. The oval-shaped eggs are capped and reach a diameter of 0.099-0.132 mm.

As a result of dissections, one of the trematodes found in the small intestine of ducks and geese was Echinoparyphium.recurvatum. The prevalence of the trematode in the intestines of waterfowl was 3-9 individuals in geese (average intensity index 3.5 individuals) and 2-7 individuals in ducks (average intensity index 2.9 individuals). The body of the helminth resembles a hook with a curvature in the neck region. The length of the trematode is 2-5 mm, and the width in the most expanded part, the ventral region, reaches 0.4-0.9 mm. There are large spines arranged in rows on the cuticle in the front part of the body. Up to 50 cone-like teeth are located on the bean-shaped neck surrounding the oral sucker. The diameter of the spherical oral sucker is 0.099-0.130 mm, and the diameter of the elongated, slightly protruding abdominal sucker is 0.035-0.090 mm. The oval-shaped genital bursa is located between the branched intestine and the abdominal sucker. Two elongated oval-shaped, 0.027-0.045 mm in diameter, ovate helminths are located in a row on the ventral side of the body. The relatively large, oval-shaped larva is located between the ovules and the abdominal sucker. The rest of the body is occupied by the larva, which contains numerous, oval-shaped, capped eggs. The diameter of the eggs reaches 0.09-0.11 mm.

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Since both types of trematodes are biohelminths, their development is completed with the participation of intermediate hosts, freshwater snails, fish, aquatic insects and crustaceans. Two intermediate hosts are involved in the development of their larval stage. Imaginal trematodes, which inhabit the intestines of birds, transmit their eggs to the external environment through the feces. Further development of the helminth can continue if the eggs fall into the aquatic environment. Miracids develop in the eggs that have fallen into the water. Then, breaking the egg cover, they fall into the water and actively move with the help of their cilia. Miracids can survive in water for 18-24 hours. If the larvae can fall into the body of the first intermediate host (aquatic snail and crustaceans), then the miracidis develop depending on the temperature (Gongadze, 1993).

Thus, when the water temperature is 20-220 C, E. revolutum miracidis develop in the body of the intermediate host for 9-10 days, and E. recurvatum miracidis for 11-13 days, losing their cilia and turning into inactive sporocysts. Oval-shaped sporocysts are enriched with cellular elements and pass into the redi stage. The redi, in turn, turn into cercariae. In tailed cercariae, all the embryonic beginnings of the adult helminth - gonads, suckers - are formed. All these stages of development are completed in the body of the first intermediate host for 49-80 days. Then the freed cercariae actively move and find their second intermediate hosts. Their survival period in water lasts 20-24 hours. If they do not find a second intermediate host during this time, they die. Cercariae that fall into the body of the second intermediate host lose their tails and turn into cysts, which is called metacercariae. The spherical, invasive larvae, metacercariae, can inhabit all the internal organs of the snail. When waterfowl eat intermediate hosts (water snails, fish, insects, etc.) containing invasive metacercariae, adult trematodes form in their digestive tract within 9-18 days.

Capillaria anseris nematodes were detected in the small intestine of geese subjected to slit examinations. The distribution of the nematode, which was observed more intensively mainly in geese up to 4 months of age, was 3-9 individuals (average intensity indicator 3.1 individuals). Along the length of the helminth, the cuticle has strip-shaped lines on the lateral and medial surfaces. The length of the male C. anseris nematode, which has sexual dimorphism, is 9.5-13.0 mm, and the length of the females is 14.5-17.0 mm. The size of the barrel-like egg of the helminth is 0.048-0.055 mm, and there are plug-shaped nodes at both ends (Aghayeva, 2014).

Since the C.anseris nematode is a geohelminth, its biological development occurs without an intermediate host. In the external environment, at a temperature of 20-250 C and appropriate humidity, larvae develop within 8-9 days inside the eggs that fall into the soil through the bird's droppings. When geese swallow these invasive eggs in walking areas and yards, imaginal helminths develop in their intestines for 3 weeks. C.anseris can live in the intestines of geese for up to 7 months. Appropriate temperature and humidity are essential for the development of the helminth. In cold weather, early spring, autumn and winter, invasive larvae cannot develop inside the eggs that fall into the environment and are destroyed (Allen, 1984).

In the helminthological examinations conducted, the nematode Capillaria obsignata was detected in the small intestines of chickens up to 3-6 months of age. The number of nematodes in the examined intestines was 1-11 individuals (average intensity indicator 4.8 individuals). The length of the male nematode is 7.5-10.5 mm, and the length of the female is 12.1-15.3 mm. The size of the barrel-like egg of the helminth is 0.045-0.060 mm, and there are clearly distinguishable, convex, plug-shaped nodes at both ends. The development of the C. obsignata helminth proceeds in the same way as the C. anseris nematode. If the eggs fall into the pastures and walking areas through the chickens' droppings, and there is a suitable temperature and humidity, invasive larvae develop within 8-10 days. When chickens eat helminth eggs, which contain invasive larvae, adult helminths develop in their intestines within 3 weeks..

Amidostomum anseris nematodes were detected under the cuticle of the muscular stomach of geese and ducks that underwent dissection examinations. The distribution of the nematode, which was

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observed more intensively mainly in waterfowl up to 3-4 months of age, under the cuticle of the muscular stomach was 5-14 individuals in geese (average intensity index 4.8 individuals) and 3-12 individuals in ducks (average intensity index 4.1 individuals).

The length of the male helminth is 9.8-14.5 mm, and the length of the female is 16.6-20.5 mm. On the front side of the body of the nematode there is an oral capsule and a little further there are 3 cone-shaped chitinous teeth. Around the capsule there are 3 pairs of suckers. Starting from the oral capsule to the end of the body, a food strip consisting of the pharynx, esophagus and intestines extends and ends with an anal opening (Cowan, 2005).

A. anseris is a geohelminth that develops without the participation of an intermediate host. The oval-shaped eggs of the helminth, with a diameter of 0.08-0.11 mm, fall into pastures and walking areas through the droppings of waterfowl. When the temperature and humidity in the environment are suitable (23-280 C), invasive larvae develop inside the eggs, which can move for 3-5 days. Geese and ducks become infected when they ingest these larvae with feed and water in waterfowl, pastures and walking areas. Larvae ingested by birds live in the glandular stomach for 4-5 days, then pass under the cuticle of the muscular stomach and reach the imaginal stage in 16-22 days. The nematode can live in the muscular stomach of geese and ducks for 12-15 days.

During helminthological examinations, the nematode Ascaridia galli was mostly found in the small intestines of chickens aged 3 months to one year. The number of nematodes in the examined intestines was 3-14 individuals (average intensity index 5.2 individuals). The length of the male nematode is 26-70 mm, and the length of the female is up to 65-100 mm. The mouth area of these yellowish-white nematodes is surrounded by three lips, each of which has a tooth-like layer. Males have up to 10 suckers in the tail. In females, the vulva is located in the middle of the body. The size of the oval, slightly flattened eggs is 0.070-0.086 mm. A. galli is a geohelminth that develops without the participation of an intermediate host. The female helminth lays a large number of fertilized eggs in the intestinal cavity of the host, and these eggs are shed into the external environment through the bird's droppings. At an environmental temperature of 20-250C and sufficient humidity, invasive larvae develop inside helminth eggs in 9 days. At low temperatures, the larval maturation period can be extended, or, conversely, at 29-350C, invasive larvae are formed in 5 days. Chickens become infected with helminthiasis when they eat helminth eggs containing invasive larvae in pastures and walking areas (Bayramov, Mammadova, 2018).

In the intestines of the host, larvae hatch from eggs, attach to the intestinal wall and develop. In the intestines of chickens, the larvae develop into imaginal nematodes within 27-52 days. A. galli can live in the intestines of chickens for 9-14 months (Gorokhov, 2003).

Conclusion

During helminthological examinations, the Heterakis gallinarum nematode was detected in the cecums of chickens aged 3 months to 1 year. The number of nematodes in the examined cecums was 5-16 individuals (average intensity index 6.3 individuals). Males and females of this white, milky nematode have almost the same size (5.8-11 mm). The mouth of the helminth is surrounded by three lips. The hole of the food pipe opens directly into the intestine. The H.gallinarum nematode has oval-shaped eggs with a diameter of 0.066-0.800 mm. These eggs fall into the external environment through the bird's hair, and at favorable temperatures and humidity, the invasive larvae inside them develop for 5-10 days. When chickens ingest such invasive larval eggs with feed and water, larvae hatch in their small intestine and migrate to the cecum in 2-3 days, where they develop into imaginal helminths in 20-24 days. H. gallinarum can survive in the intestines of birds for up to a year.

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Ecological Problems of Land Cover in Azerbaijan and Ways to Eliminate Them

Abstract

Azerbaijan, in addition to being a country with diverse natural and geographical conditions, also has a rich soil cover. However, in recent decades, as a result of improper use of land resources, the impact of agricultural and industrial activities, ineffective irrigation systems, as well as weak environmental control, the soil cover has faced serious ecological problems. In various regions of the country, soil erosion, salinization, pollution, and a decrease in soil productivity are observed as a result of anthropogenic impacts. Soil erosion occurs mainly as a result of deforestation in mountainous and foothill areas, excessive exploitation of pastures, and improper cultivation of the soil on slopes. This results in soil washing and a decrease in productivity. In the lowland region, improper construction of irrigation systems and poor development of the drainage network lead to soil salinization, which negatively affects agricultural productivity. In addition, industrial waste and excessive use of pesticides and chemical fertilizers in agriculture cause chemical pollution of the soil cover.

Keywords: *soil degradation, erosion, salinization, chemical pollution, land reclamation measures*

Introduction

Azerbaijan's rich natural resources and diverse climatic conditions play an important role in the formation of the country's land cover. These lands not only constitute the main basis of agriculture, but also are one of the main factors ensuring the sustainability of ecosystems. However, in recent years, intensive industrialization, population growth and unsustainable use of natural resources have turned the protection of land resources into an important ecological and social problem. In this regard, the issues of land protection, restoration of their quality and sustainable use have become an object of urgent scientific and practical research (Hasanov, 2001, p. 32). Although the factors affecting land cover in modern times are different, their common result is the deterioration of soil quality indicators. The ineffectiveness of traditional farming methods, improper use of water resources and changes in natural landscapes complicate the restoration of land resources. All these situations pose a serious threat to food security, environmental protection and sustainable development of agriculture in the country. Ecological problems of soil cover are among the issues discussed not only at the local level, but also in the regional and international context. To solve these problems, it is necessary to apply both regulatory and legal mechanisms at the state level and implement scientifically substantiated measures. Research conducted in this area in Azerbaijan requires a deeper study of factors such as soil degradation, erosion processes, salinization and pollution and the identification of ways to eliminate identifies the main sources of danger, and focuses on practical and scientific approaches recommended for eliminating existing problems. The goal is to formulate effective approaches aimed at the protection and sustainable use of soil resources (Mammadov, 2007, p. 856).

Research.

Ecological Status and Prospects for Sustainable Use of Land Resources in Azerbaijan

Land resources are vital components of nature, playing a key role in ecosystem productivity, the water cycle, and biodiversity. Azerbaijan’s diverse climate and geography have led to various soil

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types. However, in recent decades, soil quality has significantly declined—evidenced by reduced arable land, falling productivity, degraded structure, and weakened biological activity. These changes stem largely from human activities, such as unsustainable agricultural practices, poor irrigation management, and chemical overuse. Climate change has further intensified erosion and salinization. Given this, sustainable and planned land use has become essential. Soil degradation not only disrupts ecosystems but also threatens food security and socio-economic stability. Thus, land use strategies must consider long-term environmental and social impacts alongside short-term economic gains (Aliyev, Aliyev, 2023, p. 33). Sustainable use involves protecting, restoring, and preserving land for future generations. This requires science-based management, land monitoring systems, and stronger environmental legislation. The study explores local and regional causes of soil degradation, analyzes their geographical distribution, and proposes priority actions to restore ecological balance—laying the groundwork for land reform and technological innovation in agriculture (Abdulaliyeva, Alekperova, 2017).

Table 1. Distribution and Coverage of Land Cover in Azerbaijan by Ecological Problems (as of 2023)

Type of Problem	Approximate Area Covered (thousand ha)	Proportion of Total Land Fund (%)	Most Affected Regions
Eroded soils	1,200	14.3%	Guba-Khachmaz, Shaki-Zagatala, Ganja-Gazakh
Salinized soils	620	7.4%	Aran region, Kura-Araz lowland
Chemically polluted soils	210	2.5%	Sumgayit, Mingachevir, Absheron
Land lost to urbanization	180	2.1%	Baku, Absheron, Ganja
Soils with decreased biological fertility	950	11.3%	All regions (especially cultivation zones)

Source: FAO. (2023). Assessment of environmentally sensitive areas on soil salinization and desertification. https://storymaps.arcgis.com/stories/0459ecde8b05451cb93dbee7d0b51fcb

The data shown in the table presents various problems reflecting the ecological state of the soil cover in Azerbaijan and the areas they cover. Eroded soils account for 14.3% of the country's land fund in total and are mainly widespread in the Guba-Khachmaz, Sheki-Zagatala and Ganja-Gazakh regions. This problem leads to soil erosion, reduced productivity and damage to agriculture. Salinized soils account for 7.4% and are especially observed in areas with insufficient irrigation and drainage systems in the Aran region and the Kur-Araz lowland (Babayev, 1995). Soils associated with chemical pollution account for 2.5% of the country's land fund and are more widespread in areas under the influence of industrial waste in industrial cities such as Sumgayit, Mingachevir, Absheron. Lands lost as a result of urbanization account for 2.1% and lead to the destruction of land plots in areas such as Baku, Absheron, Ganja due to the intensification of road infrastructure and construction projects. The table shows the general picture of the state of soil resources and how each environmental problem manifests itself in specific regions (Azerbaijan State Agrarian University, 2021).

Table 2. Protection Measures Taken Against Ecological Threats to Land Resources in Azerbaijan (as of 2023)

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Ecological Problem	Type of Measure	Area Covered by Measure (thousand ha)	Most Commonly Applied Regions
Soil erosion	Soil conservation, crop rotation	1,100	Guba-Khachmaz, Shaki-Zagatala
Salinization	Modernization of irrigation systems	500	Aran region, Kura Araz lowland
Soil chemical pollution	Application of organic fertilizers	300	Sumgayit, Mingachevir, Baku
Land loss (urbanization)	Land rehabilitation	150	Baku, Absheron, Ganja
Forest soil erosion	Afforestation and reforestation	180	Gadabay, Guba, Shaki

Source: (Aliyev, Aliyev, 2023).

The table shows the protective measures adopted against the ecological hazards of soil resources in Azerbaijan and the areas they cover. Soil protection and crop rotation measures are implemented to combat soil erosion, these measures cover a total of 1,100 thousand hectares and are mainly applied in the Guba-Khachmaz and Sheki-Zagatala regions. Measures to renew irrigation systems are being taken to combat salinization, these measures cover a total of 500 thousand hectares and are mainly applied in the Aran region and the Kur-Araz lowland. The application of biological fertilizers to combat soil chemical pollution is being carried out on an area of 300 thousand hectares, and this is mainly done in the Sumgayit, Mingachevir and Baku regions. Afforestation and restoration measures are being implemented to combat forest erosion, covering an area of 180 thousand hectares and are particularly applied in the Gadabay, Guba and Sheki regions. The table shows that measures implemented to solve land problems in Azerbaijan are aimed at improving the condition of soils in different regions and strive to ensure the sustainability of the ecosystem (Hajiyev, Huseynov, 2009).

Table 3. Territorial Changes Due to Ecological Impacts of Land Use in Azerbaijan (2010-2023)

Land Use Type	Land Area in 2010 (thousand ha)	Land Area in 2023 (thousand ha)	Change (%)	Most Affected Regions
Agriculture	3,800	3,500	-7.89	Aran region, Shaki-Zagatala, Guba-Khachmaz
Forestry	300	250	-16.67	Gadabay, Shaki, Guba
Urbanization and infrastructure	100	250	+150	Baku, Absheron, Ganja
Irrigated lands	1,200	1,100	-8.33	Aran region, Kur-Araz lowland
Nature parks and ecotourism	50	70	+40	Gabala, Guba, Barda

Source: (BMT, 2024).

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The table shows changes in land use in Azerbaijan from 2010 to 2023 and their ecological impacts. While the total area of agricultural land was 3,800 thousand hectares in 2010, this area decreased to 3,500 thousand hectares in 2023, which is a decrease of 7.89%. This decrease is mainly observed in the Aran region, Sheki-Zagatala and Guba-Khachmaz regions. The area of forestry has also decreased. The forest area, which was 300 thousand hectares in 2010, decreased to 250 thousand hectares by 2023, which indicates a decrease of 16.67%. On the contrary, the area of urbanization and infrastructure development increased from 100 thousand hectares to 250 thousand hectares. This represents a huge increase of 150% and indicates the acceleration of urbanization processes, especially in the Baku, Absheron and Ganja regions. These changes have increased the impact of land use on ecosystems and led to the depletion of natural resources. The area of irrigated land has also decreased by 8.33% since 2010, from 1,200 thousand hectares to 1,100 thousand hectares. This table presents the changing areas of land use in Azerbaijan and their ecological consequences, highlighting the next steps to be taken for sustainable development and ecosystem protection (Ministry of Agriculture of the Republic of Azerbaijan, 2022).

The ecological state of land resources in Azerbaijan is of great importance both for the country's economic development and the standard of living of the population. Various methods and approaches are applied for the sustainable use and protection of land. However, land problems in the country still cause serious concerns. These problems are not only related to farming and agriculture, but also lead to environmental difficulties that hinder social and economic development. Improper use of land resources, ecological degradation and, as a result, a decrease in agricultural productivity have a negative impact on the well-being of the population living in these areas. Soil erosion, salinization, chemical pollution and other environmental problems require special measures to restore and protect the land (Hajiyeva, 2024, p. 24). North One of the main problems facing the country is the correct application of crop rotation and intensive use of land in order to restore eroded lands (Ministry of Agriculture of the Republic of Azerbaijan, 2022).

Conclusion

Improving the ecological status and ensuring sustainable use of land resources in Azerbaijan is an important component of the country's overall development strategy. The measures taken for this purpose serve the purpose of optimal land use, environmental protection and increasing agricultural productivity. At the same time, the problems arising in land resource management, in particular factors such as erosion, salinization and chemical pollution, require serious appropriate measures. The solutions presented should not be limited only to soil protection methods, but should also be aimed at promoting sustainable land use policies, education and more active participation of local communities. Such an approach, in addition to ensuring the protection of ecosystems and biodiversity, will also give impetus to the future development of agriculture. As a result, by strengthening the legislative framework for land resource management at the state level, as well as taking advantage of modern technologies and international practices, progress can be made in the efficient use of the country's land resources, improving the quality of arable land and restoring land. The work carried out in this direction is also of great importance for improving the well-being of the population in Azerbaijan and protecting land resources for future generations.

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Improvement of Remote Sensing Potential of Azerbaijan For Oil Spill Detection and Environmental Protection

Abstract

Oil spills represent one of the most critical environmental challenges, with far-reaching impacts on marine and terrestrial ecosystems, public health, and local economies. This article examines the environmental, socio-economic, and ecological consequences of oil spills, with a particular focus on Azerbaijan. Emphasizing the vital role of remote sensing technologies, the paper explores how satellite imagery, UAVs (unmanned aerial vehicle), and AI-driven monitoring systems enhance oil spill detection and response capabilities. Azerbaijan's strategic initiatives—spearheaded by Azercosmos and supported by international collaboration—demonstrate how advanced technologies can bolster preparedness for Tier 1, 2, and 3 oil spill scenarios. The study highlights key oil and gas infrastructure across the Caspian region and identifies pollution hotspots affecting biodiversity and human health. Finally, it presents a hybrid approach that integrates satellite surveillance with on-site drills and emergency training, offering actionable recommendations to strengthen Azerbaijan's environmental resilience and contribute to global sustainability goals.

Keywords: *Oil Spill Detection, Remote Sensing, Environmental Protection, Azercosmos, Oil Pollution, Caspian Sea, Satellite Imaging, Tier 1 Oil Spill, Tier 2 Oil Spill, Tier 3 Oil Spill, Hydrocarbon Contamination, Oil Spill Response, Marine Ecosystem, Petroleum Industry, Sustainable Energy, unmanned aerial vehicle, AI in Environmental Monitoring, Hybrid Satellite Monitoring, On-site Drills, Emergency Response Actions*

Introduction

Oil spills present significant environmental challenges, threatening both soil and water ecosystems. The impact of such incidents depends on various factors, including the type and volume of oil released, meteorological and geographical conditions, and interactions with marine and terrestrial ecosystems. Beyond environmental degradation, oil spills can lead to substantial economic repercussions, particularly affecting tourism and fisheries. Restoration efforts in recreational or ecologically sensitive areas become complex and costly, resulting in financial losses for affected regions (EPA, 2018).

The contamination caused by oil spills adversely affects marine biodiversity, leading to oxygen depletion, toxicity accumulation, and habitat destruction (Linda Lumor, 2018). In addition to their immediate ecological consequences, oil spills have long-term environmental effects, as hydrocarbons can persist in the environment for decades, further damaging marine and coastal habitats (Mace G Barron[1], Deborah N Vivian[1], Ron A Heintz[2], Un Hyuk Yim[3], 2020). Research has shown that chronic exposure to petroleum pollutants can cause reproductive and developmental issues in aquatic organisms, ultimately disrupting food chains and ecosystem stability (Zunaira Asif Zhi Chen, Chunjiang An, Jinxin Dong 2022).

Furthermore, the socio-economic impact of oil spills cannot be overlooked. Tourism, one of the key economic sectors in coastal areas, can suffer severe downturns due to oil pollution affecting beaches and marine recreational activities (Williams & Davies, 2016). The fishing industry is another sector heavily impacted, as oil contamination can lead to large-scale fish mortality and bioaccumulation of toxins in seafood, causing significant financial losses and health concerns (Martinez et al., 2020).

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Azerbaijan, as a country with a long history of oil production, faces increased risks of oil spills, particularly in the Caspian Sea. The region's hydrocarbon-rich reserves make it susceptible to accidental spills from offshore drilling, pipeline transportation, and tanker operations. Consequently, it is imperative to enhance Azerbaijan's remote sensing capabilities to improve oil spill detection and environmental protection measures. Advanced remote sensing technologies, such as satellite imagery and unmanned aerial vehicles (UAVs), can provide real-time monitoring, facilitating rapid response and mitigation efforts (Frontiers, 2023).

This paper explores the importance of remote sensing technologies in detecting and managing oil spills, with a particular focus on Azerbaijan's evolving capabilities. By integrating innovative satellite-based monitoring and ground-level response strategies, Azerbaijan can strengthen its environmental resilience and contribute to global oil spill response advancements.

Relevance of the research

Since Azerbaijan is a major oil and gas producer in the Caspian Sea and as offshore exploration and transportation activities increase, so do the environmental risks associated with hydrocarbon contamination. Strengthening Azerbaijan's remote sensing capabilities is essential for improving oil spill detection, response efficiency, and environmental protection. This research is particularly relevant in the context of global sustainability efforts, as it aligns with international best practices for minimizing ecological damage through advanced monitoring technologies.

Research

Oil Spill Risks and Recent Incidents

The recurrence of oil spills worldwide underscores their persistent risk to the environment and human health. A notable incident in the region is the diesel spill near Norilsk, Russia, in May 2020, where approximately 20,000 tonnes of diesel fuel were released into the environment due to a storage tank collapse, leading to extensive environmental damage.

Azerbaijan, as a major oil and gas-producing country, faces inherent risks associated with extensive offshore and onshore oil production. In 2023, Azerbaijan produced approximately 620,000 barrels of oil per day and 35.6 billion cubic meters of gas. While oil production has declined over the past decade, increased gas production has compensated for this decrease (RMI, 2)

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Role of Remote Sensing in Oil Spill Detection

Remote sensing technologies are crucial for monitoring, detecting, and responding to oil spills. Azerbaijan's national satellite operator, Azercosmos, provides essential surveillance, modeling, and visualization services during oil spill response operations. The company operates the Azersky satellite, which offers high-resolution optical imagery for environmental monitoring. Azercosmos collaborates with international partners, such as MDA in Canada, to enhance its capabilities in supporting Tier 1, 2, and 3 oil spill incidents (Azercosmos, 2024). The integration of satellite imagery into oil spill response frameworks enhances Azerbaijan's ability to assess and mitigate environmental damage in real-time (Frontiers, 2023).

Azerbaijan's Oil & Gas Infrastructure and Environmental Challenges

Azerbaijan is a key player in regional energy production, operating extensive onshore and offshore oil and gas enterprises, refineries, transportation networks, and export pipelines. Key infrastructure includes:

- Refineries: Heydar Aliyev Oil Refinery
- Transportation Pipelines: Baku-Novorossiysk Oil Pipeline, Baku-Supsa Western Export Pipeline, Baku-Tbilisi-Ceyhan (BTC) Main Export Oil Pipeline, Baku-Tbilisi-Erzurum Gas Pipeline, railroad transportation
- Terminals: Sangachal Terminal, Dubendi Terminal, Kulevi Terminal
- Petrochemical Complexes: Azerchemistry PU, SOCAR Methanol Plant, SOCAR Polymer

The Caspian Basin's rich hydrocarbon resources have led to numerous energy projects. However, oil and gas extraction, processing, and transportation have resulted in pollution affecting seawater's physicochemical parameters. Monitoring and analyses by the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan (MENR) have detected hydrocarbon contaminants in groundwater samples from the seabed, particularly in the Baku Bay area. This pollution has led to a decline in marine biodiversity, impacting the food chain and posing risks to human health through seafood consumption (MDPI, 2022).

Enhancing Oil Spill Response through Advanced Technologies

Addressing oil pollution is complex and costly, necessitating the deployment of up-to-date and efficient technologies. Effective response operations for Tier 1, 2, and 3 oil spill disasters require:

- High-resolution satellite imaging for rapid detection and tracking (EPA, 2018)
- Real-time data processing and predictive modeling (Linda Lumor, 2018)
- Collaboration with international remote sensing organizations (Martinez et al., 2020)
- Development of AI-driven analytical tools for spill detection (Frontiers, 2023)
- Investment in drone-based surveillance for enhanced monitoring (MDPI, 2022)

Recommendations: Hybrid Satellite Monitoring and On-Site Drills

To further strengthen Azerbaijan's oil spill response framework, a hybrid approach combining satellite monitoring with on-site drills and response actions is recommended:

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1. Hybrid Satellite-Based Surveillance & Ground Verification
   - Utilize satellite imagery to identify spill locations, estimate contamination spread, and prioritize response zones (Frontiers, 2023).
   - Deploy drones and on-site monitoring teams to validate remote sensing data and assess real-time conditions (MDPI, 2022).
   - Establish a dedicated oil spill monitoring unit within Azercosmos for 24/7 surveillance and rapid assessment (Azercosmos, 2024).
2. On-Site Drills & Emergency Response Training
   - Conduct regular oil spill response drills involving national agencies, oil companies, and environmental organizations.
   - Train response teams on containment strategies, clean-up techniques, and emergency coordination (EPA, 2018).
   - Integrate simulated spill exercises with real-time satellite monitoring to enhance preparedness (MDPI, 2022).

Conclusion

Oil spills continue to pose significant environmental hazards, requiring robust detection, monitoring, and remediation strategies. Azerbaijan's strategic position as an oil and gas hub necessitates the enhancement of its remote sensing capabilities. Leveraging Azercosmos' satellite technology, international partnerships, hybrid monitoring systems, and AI-driven solutions will help reduce environmental damage, protect marine biodiversity, and ensure sustainable energy production (Martinez et al., 2020). Strengthening these efforts will not only mitigate risks associated with oil spills but also position Azerbaijan as a regional leader in environmental protection and oil spill response technology (Frontiers, 2023).

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